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Public Appreciation of the Engineer in Relation to His Work

A SUBJECT which has caused a great deal of discussion amongst engineers during recent years is the lack of appreciation on the part of the general public of the importance of the work being done by the profession. One would gather from the numerous articles and editorials which have appeared in the technical press that the belief was almost universal amongst engineers that the work of the profession was much underrated. It is very doubtful if they are correct in this view. There is no question but that the larger and more important engineering works appeal very strongly to the general public and excite a great deal of interest. Such undertakings, especially during construction, while it is possible to see the operations being carried out, always call forth expressions of admiration and approval from onlookers. Who has not heard from people standing near, watching the progress of the work, expressions of approval that are most enthusiastic? And the relation of the engineer to such work is always recognized. It is true that after the work has been completed it may appeal to the public as being a great piece of construction, but that the engineer behind it is not so likely to be thought of, any more than is the artist who has painted a great picture. It is also true that there is a large amount of work being done under the direction of engineers which has become so much a part of our everyday life that it is accepted as a matter of course. The engineering behind the work is almost lost sight of by the public, but the recognition of its value is there, although it may be almost subconscious. The recognition it receives is probably just as great as it is in the case of the ordinary everyday work of any of the other professions.

Is not the whole question one of the engineer's being subject to the universal human trait, characteristic of each individual, from the office boy to the general manager, of thinking that his work is not appreciated at its true value? Perhaps it is not, but, if not, then neither is that of any one else. A few moments' reflection must lead any engineer to the conclusion that the work of his profession is at least as indispensible from the standpoint of social economy as that of any of the other professions, and on inquiry he would probably find that it is so regarded by all who are in a position to judge of the relative importance of the professions in our modern social life.

While there is no doubt that the work of the profession and its value in the development of the country are highly appreciated, what about the man who does the work—the individual member of the profession? How does he stand in the estimation of the public? It is no doubt true that engineers, as individuals, are not so well known to the general public as are members of the other professions. This is largely due to the fact that usually their work does not bring the man himself directly in contact with any large number of people. Almost every one, at some time or other, has occasion to requisition the services of some member of one of the other professions. He comes in almost daily contact with other professional men, while the probabilities are that he has never met an engineer. The engineer is employed by a company, a corporation, or a municipality, and comes in contact in regard to his work only with the representative of those for whom he is working. There is no doubt, however, that if he is a man of ability and a competent engineer he will be held in as high esteem by those with whom

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he has direct relations as will any member of any other profession of corresponding standing.

That the engineer does not occupy a larger place in the public life of the community is not to be wondered at, but the fact that he does not do so is not necessarily an indication of any lack of appreciation of his work or of him as an individual on the part of the public. The very nature of a lawyer's work leads him more or less towards a public life; he is personally before the public in a great many of his activities. A doctor's work has not the same tendency, but the practice of his profession gives him a very wide circle of acquaintances. With an engineer who is following the practice of his profession closely the tendency is altogether the other way. Except in the case of those of the profession who follow a consulting practice, his work is likely to confine him to one locality and one piece of work for a period ranging from a few weeks to a few years, while his next piece of work may take him to an entirely different place. A man with a consulting practice has more opportunity to take an active part in the public life of a community, if his inclinations lead him to do so, but he cannot take such part except at a great deal of inconvenience to himself and his work. If a lawyer has any liking for public life he is very likely to drift into it. If an engineer happens to have a similar liking he has to force his way into it against many opposing influences.

One unfortunate circumstance that militates against the standing of the profession is the fact that any person who is capable of measuring a hundred feet with a linen tape may call himself an engineer. Were similar conditions to prevail in the other professions it would most undoubtedly be found that they would be held in very much lower esteem than they are at present. While this may lower the profession in the estimation of the public, it does not alter the fact that the capable engineer will hold in the estimation of the men with whom and for whom he is working the position to which he is entitled.

If the remuneration received by engineers for their services is to be accepted as a criterion of their importance in the community, there may be good reason for their pessimism. However, it is not on account of any misconception of the importance of engineering as a profession, nor is it on account of a low estimate of the ability of engineers as a class, that the financial rewards of the profession are not greater. One of the chief reasons is the competition of men who, without any training or education, attempt to do engineering work. While such men seldom or never find employment on work of importance, their existence tends to lower the remuneration from the bottom to the top of the scale. Another very important reason is the free engineering services given by large mercantile firms. These firms employ engineers at moderate salaries to prepare designs of structures for their customers, and the firm collects what would be a reasonable fee for any engineer from their customer in the shape of profits on the goods sold. And perhaps one other reason is that the engineer is too busy doing his work to spend much time or thought on the acquisition of wealth. The engineering of their way to large fortunes constitutes the life work of many of our wealthy men. That is what they strive to accomplish. The engineer is engaged in building larger, better, and more lasting structures than "fortunes."

A fireproof building material is made in Switzerland by compressing Portland cement and asbestos fibre into blocks.

Good Roads in Quebec

THE Quebec Provincial Government have claimed, and have been given, a great deal of credit for their good roads policy. They have been strenuous supporters of the Good Roads movement, and were represented at the conventions held in Montreal and Toronto. The Acts passed by the Legislature are no doubt calculated to improve enormously both the main and local highways by giving easy terms to municipalities and by encouraging the construction of roads which will prove beneficial to the farmers as well as to urban residents. There is, we are informed, another side to the story which is proving very detrimental to many contractors. Last year, at the invitation of the Government, municipalities applied for loans, and, on the specifications being passed, let numerous contracts. As the work was commenced in the fall, these contracts were only partially completed. The contractors all over the province had invested hundreds of thousands of dollars in equipment, and naturally believed they would be allowed to resume the work at the beginning of the season, and would also be able to secure additional contracts. In this they have been disappointed. They relied on the Government's promise to finance such projects, and on the fact that at the last session a further Bill was passed for raising another $5,000,000. At the beginning of this season many contractors organized their staff and made other preparations to continue the work left over from last year, but no word of authorization came from Quebec, and the contractors found themselves in a quandary. Their expenses were still going on, their machinery was idle, and they were not earning a cent of revenue.

Visits were made to Quebec in order to learn the reason for this stoppage of work, but practically no satisfactory answers could be obtained. The contractors were told that, although the Government had ample funds, it had been decided that each municipality should not construct more than two miles of road under the old contracts, and that no new work would be allowed. The decision was based on the European situation, it being held, apparently, that this is not a time for road work to go ahead, even though contracts had been partially completed. The injustice of the decision (state the contractors) will be seen when it is stated that in some instances this two miles of work had to be divided among several firms. While the Government were making up their minds as to their policy many contractors were doing their best to hold their men together, involving a large expenditure for which they will not be able to get any return. Many, too, during the winter had hauled the stone they expected to use during the present season, which meant the investment of very considerable capital, now lying idle. Such is the present position, and unless the Government reverse their policy many contractors will not turn a wheel, and will be substantial losers.

As previously stated, the Government intimated that no fresh contracts would be sanctioned. The contractors claim that, notwithstanding, new work has been given out—some in districts where only a portion of the old contracts—the two miles for each municipality—has been authorized. The work on these two-mile stretches, much of which has been completed, will not go far to give the good roads promised and badly needed. Moreover, while there is no money for roads built under contracts let by municipalities, the Government have found funds sufficient to carry out improvements on the main highways.

The Designing of Details

ENGINEERS, as well as other men, are inclined to judge of the importance of their work by the rate of pay which it commands. As the engineer becomes older and more experienced he realizes that certain kinds of work possess advantages which cannot be measured in dollars and cents. The young engineer, however, is naturally attracted to those lines of work which seem to ensure large returns most quickly. It is to be regretted that "detailing" does not at present seem to offer a career to capable young engineers. Unfortunately it is considered merely as a stepping stone to another position, with the result that capable young men are avoiding this kind of work or are remaining in it as short a time as possible. We are just beginning to appreciate the fact that poor details are largely responsible for many failures, and also for many unsatisfactory structures, which, even though they have not failed, cannot be relied upon to carry any considerable overload. Engineers themselves are largely responsible for this condition, because many of them have considered detailing, not as designing, but as mechanical, trade-school work. The designing of details is an important kind of engineering work, and its problems are often sufficiently difficult to command the highest engineering skill.

We believe it is time for engineers to recognize the importance of detail designing, and to adopt measures which will justify engineers of ability in remaining in this kind of work. Efficient detailing requires a thorough knowledge of the strength of materials, of stresses, and of erection procedure, and the old idea that almost any man who possessed a structural handbook and a set of drafting instruments could soon qualify as a detailer was an erroneous one. Adequate pay and a proper appreciation of the importance of the work will do much toward attracting and retaining capable detailers.

Generally, the importance of the structural designer's work has been over-rated, as compared with that of the detailer. For structures of medium size it does not take the highest type of engineering ability to compute the stresses and, with the aid of a handbook, to select the size of the main sections. In bridge work, for example, to obtain the information ordinarily placed on the stress sheet does not often require exceptional ability—in fact, the man just out of college may be much more efficient in computing stresses than the experienced engineer. The prevailing notion that the well-paid engineer's work is completed when he finishes the stress sheet is wrong—it is too much to expect that the poorly-paid detailer can complete the design, as the latter is usually a man with little engineering experience.

If our structures are to be equally strong in all their parts and capable of being erected economically there should be little distinction in salary or in technical ability demanded between the designer and the detailer—in fact, one high-grade man might well do the work now done by both. The extra cost for efficient work under such a system probably would not be greater than that under the system now in use in our large offices if the cost of the "checker" is taken into consideration. The results of tests of full-size members have shown that the actual strength of a built-up member often is only a small percentage of its computed strength, due mainly to weak and faulty details. Engineers are just beginning to realize that they have little definite information on this important subject. It is hoped that the growing realization of this lack of knowledge will act as an incentive to them to make the designing of details a branch of structural engineering work worthy of the attention of capable and experienced engineers.—Engineering and Contracting.

The Mitigation of Electrolysis

By E. B. Rosa*

THIS paper summarizes the work which the U. S. Bureau of Standards has done during the last four years in studying the destructive effects of electric current on sub-surface structures and prescribing remedies for the trouble. From the results of its investigations the Bureau concludes that the proposal to fix by State law a general requirement as to voltage drop or current density in the rails is not logical, in view of the great variations in the damage which can result under different conditions with the same voltage drops.

One of the first methods resorted to as a means of preventing damage to buried gas and water pipes by electrolysis and soil corrosion consists in covering the surface of the pipes with a coating intended to insulate them from the surrounding earth. In many cases pipes have been so protected from soil corrosion but it is doubtful whether there is any instance on record where damage by electrolysis has been effectually prevented in this way if the voltage conditions were at all severe. On the contrary, there have been cases where such coatings have done actual harm, as they tend to fail in spots, and so permit the current to escape from the pipes at such places with a greater current density than would be the case otherwise, and so aggravate the local damage.

The paints, dips, and wrappings tested by the Bureau of Standards were found to be of little or no value in protecting pipes from electrolysis when applied to the positive areas near power stations where the current is tending to leave the pipes. The Bureau has come to the conclusion that money can be expended more profitably in other directions than in an attempt to insulate gas and water pipes from the earth.

Insulating Joints

The Bureau has found insulating joints of great value in reducing the current in pipe lines, and so reducing the corrosion caused by such current. Where the potential gradients are high the joints must of course not be placed too far apart, as in that case the potential difference at each joint would be sufficient to cause considerable joint electrolysis. Insulating joints should not be depended upon as the sole means of protection to pipes, but they are economically and mechanically practicable, and are a very important auxiliary means of protection, particularly in the case of gas pipes. They are used less often in water pipe lines.

Track and Pipe Drainage

Alternative methods of electrolysis mitigation are by the track drainage system and the pipe drainage system. The first of these methods is to be preferred if it can be carried out economically. It has, however, been thought by many to be prohibitive in cost, and has been very little used in American cities. The pipe drainage system, on the contrary, has been strongly advocated and in one form or another much used. The investigations of the Bureau of Standards, which have been extended over several years, have convinced its members that the pipe drainage system as a principal method of protection is not only complicated and expensive to install and maintain, but is in the long run not an adequate remedy for electrolysis troubles. On the other hand, the track drainage system when properly designed and installed is simpler, more effective, and far less expensive than has been supposed.

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*Chief Physicist, U. S. Bureau of Standards, in Engineering Record.

Owners and managers of water-works should co-operate with the gas and telephone companies and railways in studying the problem of electrolysis mitigation in an open-minded and progressive manner. The taking of the matter into the courts is to be deplored. It is better to employ engineers to work together to solve the problem in a thorough and efficient manner than to employ experts to testify in court as to who is responsible or what are the damages. As the damage is cumulative from year to year and the rate increases as the traffic increases, there will be no better time than the present to take up the matter.

Considerations Affecting the Design of Highway Bridges

By Willis Whited*

THE engineer designing bridges for public use is always more or less at a loss to know what loading to assume for bridge floors. Curbs and railings offer further doubts. A few of the difficulties are outlined in the following article, with suggestions embodying the writer's opinion.

Roadway Loading

Unusual loads.—Should he assume the heaviest known loads and design with the ordinary unit-stresses? In large cities this is good practice, but even there the engineer is hardly justified in designing all the bridges in the city, large and small, to carry the heaviest monuments, castings, steel beams, building members, or stone columns that can be brought into the city. A limit must be fixed somewhere, beyond which the owner of the load is obliged to provide for its transportation by strengthening bridges, adopting different lines of travel, dividing up the load, using special trucks, or otherwise. It seems extravagant to add a large percentage to the cost of a bridge in order that it may carry a load heavier than is likely to be brought to it once in five years, especially as the necessity of carrying such loads is rarely absolute.

Street cars.—It would seem that all bridges except on boulevards and in parks should be designed to carry street cars, whether they are actually used on that street or not. It is impossible to accurately forecast the growth of a city or to know what traffic is to come on a given street in twenty-five years. Street cars are with us, and must be provided for, and we can only guess as to the weight they are likely to attain.

It would probably be desirable to build bridges in parks and boulevards no heavier than is necessary to carry the heavy class of automobiles and the road rollers used for paving such roads, thus placing an obstacle in the way of the street railway corporation's grabbing such roads by hook or by crook to the detriment of the traffic they were intended to carry. The same may be said of inter-city highways which are only wide enough to carry two lines of traffic.

Bridges in public streets should be built to carry inter-urban cars weighing 50 tons each. While this is much heavier than ordinary cars, it must be borne in mind that suburban cars are destined to a wide extension, and almost any street in a city is liable at some future time to be called upon to carry them.

Motor trucks.—Roads between large towns are, it seems to the writer, destined eventually to be subjected to the traffic of heavy motor trucks which will carry miscellaneous freight from store, factory and warehouse to residence, or from the small town or the country to the warehouse in the city.

So long as rubber is used for tyres, and the present materials for paving, it is hardly to be feared that the gross weight of the truck will greatly exceed 20 tons, with about two-thirds of the weight on the rear axle. In the opinion of the writer, all bridges on important thoroughfares should be designed to carry the load, which will safely cover traction-engine loading.

There are bridges in remote districts which could not without extravagance be built to carry 20-ton trucks; but the road roller and traction engine are a permanent institution. I would recommend for such bridges a 12-ton roller as the lightest design load for any bridge on a public road. Sometimes there is difficulty in deciding whether a given district will remain remote. I would recommend resolving all cases of doubt in favor of the heavier loads.

Cases often arise in which designing a very large bridge for the heaviest loading would add so much to the cost as to be an unreasonable burden on the taxpayers, while there is another route not requiring such an expensive bridge which would carry exceptionally heavy loads without undue inconvenience to the public. In such cases notices should be placed warning vehicles carrying loads exceeding a certain amount to take some other route. The driver of a heavy load may feel like taking a chance; nevertheless, there is plenty of law holding him responsible for the resulting accident.

Sidewalk Loading

While roadway loadings are subject to change as above noted, sidewalk loadings cannot change as the years pass, either in character or amount.

Crowds.—The weight of a dense crowd of people has in some cases by special exertion been brought as high as 150 lbs. to a sq. ft. of floor, but such loadings are so rare that it seems to the writer not unreasonable to allow stresses under this intensity of loadings to approach the elastic limit. An ordinary standing crowd will rarely weigh more than 80 lbs. to the sq. ft., and the only occasion on which crowds even of that density will be gathered will be in cases of some local excitement, such as accidents or similar occurrences in the water or the roadways. In such cases the densest part of a standing crowd can hardly be more than four deep; those in the rear will keep moving, and a crowd with freedom enough to move at all will rarely exceed 40 lbs. to the sq. ft. An assumed sidewalk load of 100 lbs. to the sq. ft. on a 4-ft. width, with 50 lbs. to the sq. ft. on the rest of the sidewalk, is ample for any kind of a bridge, but should be provided for in all bridges, whether urban or not, because any district sufficiently populous to require sidewalks at all on the bridge will occasionally produce crowds of considerable density.

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*Bridge Engineer, State Highway Department of Pennsylvania, Harrisburg, Penn.

Dense crowds of much greater depth occasionally collect to listen to musicians or street speakers, but such gatherings are never allowed on bridges.

Snow.—It is hardly possible for crowds to become so dense in cold weather. Since the weight of ice or snow seldom exceeds 13 lbs. to the sq. ft., it is not necessary to add anything for its weight.

Runaway vehicles.—If the bridge is at the foot of a steep grade it may happen that street cars, escaping from the control of the motorman, will leave the rails and go over on the sidewalk. It may be worth while to allow for such accidents in designing sidewalks, by making the curb high and strong enough to prevent vehicles getting on the sidewalks, i.e., never less than 6 ins. high, and often more.

In providing for the case of a car actually mounting the curb and running on the sidewalk three times the normal stress could be allowed; this might result in badly damaged sidewalks, but would prevent loss of life.

The planks or other details of the sidewalk should be designed to carry not less than 250 lbs. concentration, because people of that weight are not uncommon, and a person in walking always places his whole weight on one foot. Plank walks are rapidly going out of use, but they will be with us for many years to come.

In fixing the thickness of a plank a reasonable allowance must be made for wear and deterioration.

Curb Height

Horse-drawn vehicles.—Even in the case of a runaway the vehicle must follow the horses. Horses, except when under the spell of frenzied fear, will never bolt over a fence, and therefore it would seem that, where there is no sidewalk, a reasonably high fence on a curb of about 6 ins. is all that is required. If there is a sidewalk it is well to make the curb about 16 ins. high, which only the lightest wagons could mount. But the sidewalks should be made sufficiently strong to carry the weight of a horse and a light wagon without greatly exceeding the elastic limit.

Automobiles.—The ordinary touring car is very often driven at a high rate of speed. Occasionally the driver loses his head, or the steering gear gets out of order, in which case the car is liable to mount the sidewalk. The best preventive of this accident, perhaps ould be to make the curb about 16 ins. high and sufficiently substantial to resist the impact of the car.

A 10-in. curb is sufficiently high to take care of most accidents. But where there is a sharp curve on the approach, or where the bridge is very wide, so that an unruly car would be liable to strike very nearly square, the higher curb is imperative.

As to motor trucks, which travel at a much lower rate of speed, the driver will probably become aware of accidents to any part of his machine in time to stop before the truck mounts the curb.

Railings should be made to resist a lateral pressure applied at their tops equal to one-fourth the weight of a row of men leaning against it, or approximately 40 lbs. to a lin. ft. If the railing is not so constructed that it is impossible for men to climb upon it, it should be strong enough to sustain a vertical load of at least 100 lbs. to a lin. ft.

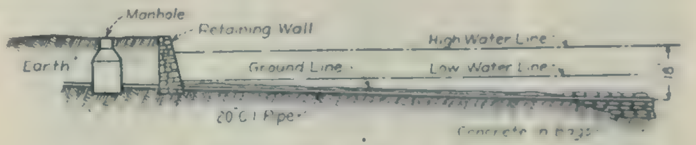
If the railings are on a sidewalk, there should be no opening more than 6 ins. wide, on account of the danger to children, either by walking between the balusters or falling down and rolling underneath.—Engineering News.

Cost of Depositing Concrete in Bags Under Water

By H. R. Ferriss, Victoria, B. C.[1]

A 20-in. cast iron outfall was laid from a point on shore to a distance of 720 ft. out from shore, at which point the end was in 18-ft. depth and a swift off-shore current. The outfall follows a channel between high rock reefs, and the pipe for its entire distance—with the exception of 120 ft. of the outfall end—is laid in a ditch dredged in clean sand. At the outfall end the floor of the sea falls away somewhat faster than the grade of the pipe, and advantage is taken of this to hold the end of the pipe line off the floor of the sea. It was considered advisable by the engineer in charge to rest the pipe on concrete deposited in bags, and the outermost end, owing to the swift current and heavy winter storms, is heavily anchored with concrete in bags.

A 1:3:6 mixture was used. A scow was anchored near the outfall end, and aboard it the concrete was mixed and sacked dry. The sacks of concrete were then lowered in a sling, and placed one at a time, by the diver, who afterwards ripped them open with a knife as placed. The concrete showed no sign of setting up for two days. After the seventh day it was fairly well bonded. It is now, after one year, a fairly good mass of concrete, which shows no damage, either from the swift current or from storms, from whose action, except the fiercest, however, it is probably protected by its depth.



Section showing location of outfall.

It will be noted that the costs of labor only are given, and they depend considerably on locality and weather, which in this instance was exceptionally fine. The costs of materials are easily ascertained for any locality. The costs for the use of scows, engines, etc., will depend entirely on locality and weather conditions. The amount of concrete deposited was 80 cu. yds. and it cost as follows:

Sacking and Mixing Concrete:	Total	Per Cu. Yd.
Foreman, 19 hrs. at 35 cents	$ 6.65	$0.082
Labor, 400 hrs. at 30 cents	120.00	1.500
Placing:		
Diver, 120 hrs. at $1.00	120.00	1.500
Tender, 120 hrs. at $0.50	60.00	0.750
Compressor eng., 60 hrs. at $0.40	24.00	0.300
Labor, 250 hrs. at $0.30	75.00	0.938
Total	$405.65	$5.070

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[1] In Engineering and Contracting.

A Combined Power, Pumping and Filter Plant

Details of Municipal Undertaking at Medicine Hat, Alberta—Boilers Fired with Natural Gas to Provide Steam for Turbo-Generators

By W. S. Lea*

IN 1912 the City of Medicine Hat, Alberta, undertook the installation of a new power, pumping and filter plant. The existing works included a pumping and filter plant on the south bank of the South Saskatchewan River, about one-quarter to one-half mile from the centre of the city, and an electrical power plant, built a short time previously, about two and one-quarter miles further up the river. The equipment in this power plant included two 125-kw. alternators driven by engines operating on natural gas. In the pumping plant both gas and steam engines were in service. The general elevation of the built-up portion of the city is about 90 feet, and the water distribution system was in connection with a 400,000-gallon standpipe with its top at El. 274. It was too low to provide pressure for the higher parts of the city, which were being rapidly developed.

City Reservoir, Medicine Hat.

Without going into details, the existing works were so inadequate that it was absolutely necessary to install a new pumping and filter plant. As the recently constructed power plant had not been entirely satisfactory, it was also considered advisable to provide for a moderate commercial power load in the new installation. A combined power, pumping and filter plant was therefore decided upon, to be erected on a site on Noble Street adjacent to the existing power plant.

The population of the city was then about 11,000, the commercial power load (electric) about 130 kw., and the average daily per capita water consumption, including a supply for the Canadian Pacific Railway, about 150 gallons. The South Saskatchewan River is the only available source of water supply; this river is not badly polluted, but, like most Western rivers, the turbidity is high during the spring freshets.

Medicine Hat is situated in a splendid agricultural district and a famous natural gas field. An abundant supply of gas for all purposes has been developed in the city, and the Corporation was in a position to furnish gas of a high calorific value for the new plant at a merely nominal rate—approximately one cent for every 1,000 cubic feet. It was offered for industrial use at five cents per 1,000 cubic feet, and large users were permitted to use certain wells on exceptionally favorable terms, practically at cost. This consideration naturally suggested the probability that the bulk of the power required for industrial purposes would be developed from privately-owned gas wells.

At the best, the power proposition was an uncertain one to deal with, as the city was experiencing a development approximating a "boom," and the usually accepted formulas for growth in industries and population might not apply. However, it appeared reasonable to expect that within a few years the water consumption would be doubled and that the average combined pumping and industrial power load would range from 600 kw. to 1,200 kw., about one-half of which would be required by the pumps and auxiliaries in the power station.

The conditions determining the general scheme of improvements were briefly as follows:—

The water supply had to be taken from a river with 30 feet range in level from low water to flood water (El. 65 to El. 96). In the dry weather season the river is so shallow that the intake had to be located at midstream, and this intake and the intake pipe had to be protected, if possible, against damage from ice jams, which are liable to occur with rising water in the spring.

The topography of the site for the plant varies from contour 90 at the river bank to contour 107 at Noble Street, fronting the site.

A water supply for domestic and fire purposes had to be provided, with a distribution system ranging from El. 90 to El. 220 or higher. Wood pipe had been installed in some sections of the lower levels. Speaking generally, the old system had not been designed for the working pressures which would be imposed upon it if in direct connection to the system for the higher levels. Moreover, apart from the heavy fire draught which must be provided for in a city of this size, the so-called domestic consumption varied to an unusual degree, owing to draughts for railway and industrial purposes and the heavy use of water for lawn and street sprinkling, etc.

Fortunately, a site for a service reservoir was available immediately south of the new plant. This site was of sufficient area to accommodate any future extensions which might be required, and, being at El. 370, could provide fairly satisfactory pressures, since the business and manufacturing districts are on the lower levels.

Equipment of Plant

The selection of the type of prime mover to be adopted for the new plant was an important matter. The choice lay between gas fired steam boilers with turbo-generators and gas-engine driven generators. The steam plant was the cheaper one to install, was more flexible, and was considered more reliable and easier to maintain, but was admittedly inferior to the other from the point of view of fuel consumption. An-

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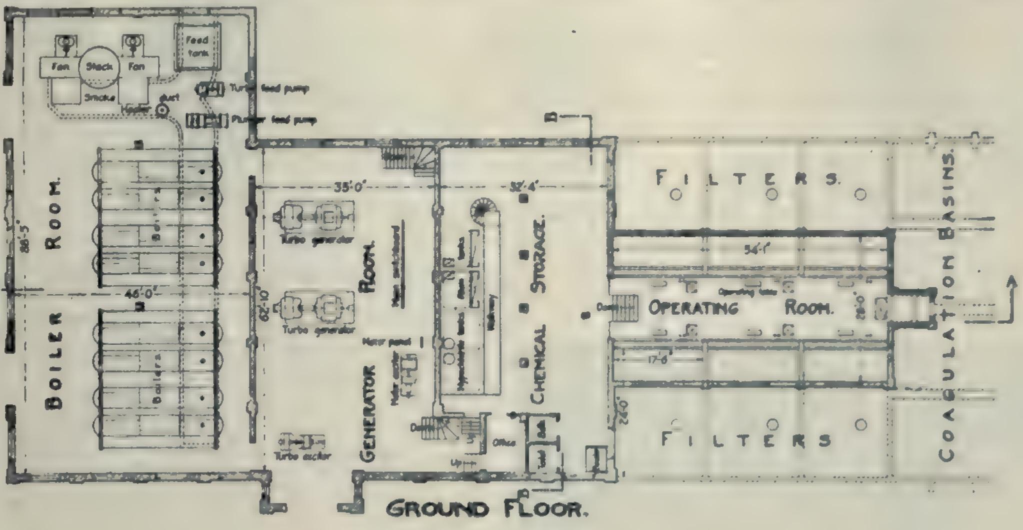
* Of the firm of R. S. & W. S. Lea, consulting engineers, Montreal.



Plan of ground flour.

other factor which had to be considered was the possibility of the city's being obliged to resort to the use of coal fuel. It is considered unlikely that such a contingency will arise, at least during the life of the present plant. Both types of prime mover permit of changing over to the use of coal, but the steam plant is the more convenient and economical in this respect, as no provision in the power station for additional equipment is needed. Hence, having regard to the low cost of fuel, it appeared that the considerations governing the choice of prime mover were, in order of importance:—1st, simplicity and reliability; 2nd, first cost; 3rd, cost of operation, including operators' salaries, cost of renewals, and repairs. Gas fired boilers and turbo-generators were therefore recommended, with all pumps and other secondary equipment motor-driven except the boiler feed pumps and one reserve exciter unit.

The scheme recommended included:—

1. A concrete intake pier with a 30-inch cast iron intake pipe from it to a suction well on the river bank, which was already under construction.

2. A 6,000,000-gallon-a-day mechanical gravity filter plant, with provision for a minimum of three hours' sedimentation and a clear water basin under the filters with a capacity of 125,000 gallons.

3. Three 3,000,000-gallon-a-day low lift pumps for pumping raw water from the suction well to the coagulation basins or to the condensers as hereafter described.

4. Three 3,000,000-gallon-a-day high lift pumps for raising filtered water from the clear water basin to the service reservoir or pumping it into the distribution system.

5. Four 400 h.p. water tube boilers set in two batteries.

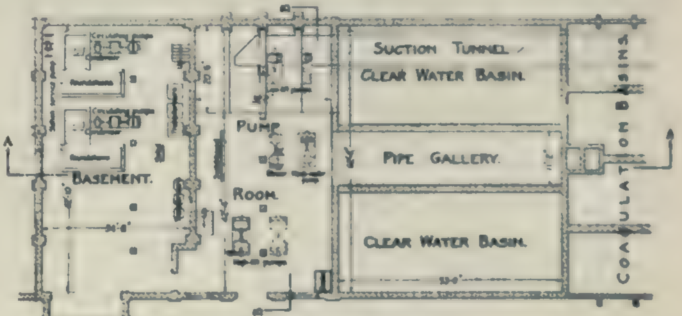
6. Three 750 kv.a. condensing turbo-generators with an overload capacity of 25 per cent. for two hours.

7. A 3,000,000-gallon service reservoir on the site previously referred to.

8. 9,500 feet of 20-inch rising main from the plant to the reservoir, with an 18-inch feeder off the main along Sissons Street for 11,000 feet to connect with the low level system through a pressure regulating valve set to maintain a pressure on this system practically the same as that previously afforded by the old standpipe.

On account of the occasional flooding of the site adjacent to the river during high water and the necessity of placing the low lift pumps in a pit to be within a reasonable suction lift of the river in low water, the general layout of the plant and the relative floor levels are as illustrated.

The coagulation basins are in two units, each with a preliminary and a final basin. The filters are in six units, each of a capacity of 1,000,000 gallons a day, and are 17 ft. 6 ins. by 24 ft. in plan. The clear water basin is beneath the filters, immediately adjacent to the coagulation basins, and with its floor at the same level as theirs. The effective depth of the sedimentation basins is 16 ft. 6 ins., and the effective depth of the clear water basin is reduced by provision for the drop through the filters to about 6 feet.



Plan of basement.

Power Plant

The boiler room and generator room floors are on the same level. The boilers are gas-fired, and induced draught is provided by two steam-driven fans in the smoke duct, discharging immediately above the roof through an 8-foot steel stack. Each boiler has 4,020 sq. ft. of heating surface. There are two feed pumps—a multi-stage turbine pump driven by a steam turbine, usually in service, and a reciprocating pump as a standby. Both feed pumps have suction connections under a moderate head from a concrete feed water tank in the corner of the boiler room, which can be filled off the discharge main or by the service pump drawing from the sedimentation basins. The feed pumps and fan engines exhaust into a Reilly multi-coil vertical heater.

Each turbo-generator unit consists of a Fraser and Chalmers 3,600 r.p.m. steam turbine direct connected to a Siemens 2,200-volt, 3-phase, 60-cycle, 750-kv.a. generator. A Koerting ejector condenser is provided for each unit, and the injection water for the condenser is taken from the discharge header of the low lift pumps through a small centrifugal booster pump to increase the pressure of the discharge of the low lift pumps sufficiently for the condenser supply. The discharge from the condenser enters an open concrete hot well. A common motor drives both the booster pump and a small centrifugal return pump with submerged suction in the hot well which returns any desired proportion of the water from the hot well to the coagulation basins. This is effected by connecting the low lift pump header through a pipe with the discharge of the return pump. After the junction of the return pipes, the water flows through one pipe equipped with a water level controller, to the coagulation basins. Thus there are, so to speak, two circuits for the low lift pump discharge—one through the booster pumps, condensers and return pumps to the common supply main to the basins, and the other direct to this common supply main from the low lift discharge header. By simple hand regulation it is possible to turn any proportion of the low lift pump discharge into the coagulation basins for the domestic supply, or any proportion of it may be used for condensing purposes and afterward returned to the coagulation basins for domestic use, or allowed to waste to the river through an overflow and drain from the hot well. All of the condensing water automatically runs to waste when the filters are shut down.

Gas fired boilers.

There are two exciter sets for the main units—one motor driven, and the other direct connected to a Terry steam turbine.

The main switchboard has eight panels—two for the generator control, one for the exciter control, one for the Tirrel voltage regulator, two for the outgoing lines, one for the high tension current supply to the high lift pump motors, and one for the supply to the transformers, which deliver 220-volt current for the low lift pump motors, wash water and circulating pumps, blower, exciter, lighting, etc.

The condensers, circulating pumps, air duct to turbines, service pump and transformers are located in the basement under the generator room.

The pump room floor is on two levels. On the higher level, which is at the same elevation as the generator basement floor and the floor of the filter pipe gallery, are the high life pumps, the wash water pump and the blower for the filters, and the switchboard controlling these units. The low lift pumps are on the lower floor, or in the pump pit, with shafts about 17 feet above low water. These pumps have independent 16-inch cast iron flanged suctions, laid in a concrete tunnel passing under the west coagulation basin to the suction well. These suctions are provided with foot valves, and the pumps are also equipped with ejectors for priming. The high lift pumps are two-stage Drysdale turbine pumps, direct connected to 325 h.p. Siemens induction motors, taking current at 2,200 volts.

Filters and Intake

The coagulant storage and chemical mixing and dosing equipment is immediately over the pump room, and is connected with the generator room. There is a one-ton hydraulic elevator to this floor, and a ten-ton travelling crane in the generator room.

The building is of reinforced concrete with brick and tile curtain walls and a flat concrete roof covered with Johns-Manville asbestos roofing. The roof of the filter plant is slated.

As originally designed, the plant is capable of handling easily from 5,000,000 to 6,000,000 gallons of water a day and generating 1,200 kw. of electrical energy for pumping and commercial purposes, with one boiler, one turbo-generator, one high lift pump and one low lift pump in reserve. It is true that this leaves no filter reserve, but as a matter of fact the months of maximum water consumption in Medicine Hat are not the months of maximum turbidity, and, allowing for washing, the effective capacity of a filter tank is about 97 per cent. of its nominal capacity. If one filter tank were out of commission, 5,000,000 gallons of water a day could be easily handled at the least. In cold weather, one low lift pump can supply enough cooling water for two turbo-generators, but in the summer two low lift pumps are required for this service if it is

Turbo-generators and switchboard.

desired to limit the temperature of the water entering the coagulation basins to about 80 deg. F.

Condensing turbo-generators were adopted because, apart from being more efficient, this feature resulted indirectly in a lower first cost for the whole plant on account of the smaller boiler capacity required, thus showing a saving in the cost of buildings as well as in the cost of boilers. Impulse turbines and ejector condensers were adopted on account of their simplicity and reliability.

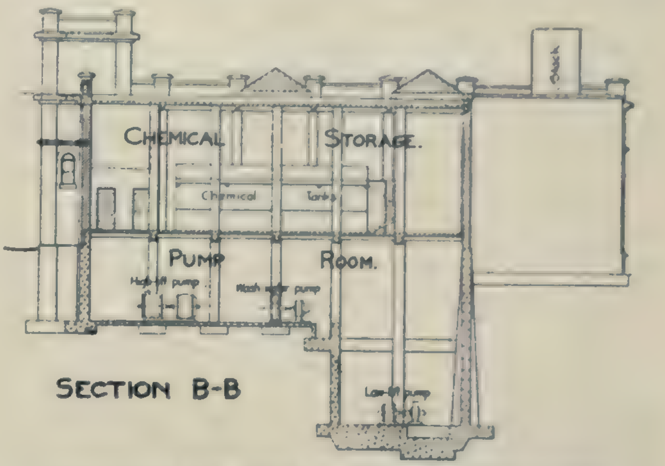
The plant is so designed that it may be extended westward by additions similar to the original installation.

On account of the ice jams and low water in certain seasons, the intake pipe had to be laid in a trench in the river bottom and the intake pier had to be designed either massive enough to withstand any ice shove or low enough to escape the worst effects of one. It is doubtful if the integrity of the pier could be guaranteed by any design at a reasonable cost, and it was decided to adopt a low concrete structure with a gently sloping upstream face, carried below the river bed. The inlet to the pier is through a removable iron screen set in the outer face parallel to the direction of the current. This inlet is in the deepest part of the river, and its sill is above the river bottom. The 30-inch cast iron intake pipe enters the pier below the river bed and is carried in a trench to the suction well. There is a circular emergency opening countersunk into the top of the pier and covered with a very coarse grid, over which is placed an iron cover with a fixed vertical ring handle for easy removal. Provision is also made for blowing off this cover by the back pressure from the street mains, which are connected to the intake pipe, should it become impossible to remove it in any other way. The emergency inlet is for use only if the regular inlet become choked with debris, frazil, etc.

The suction well is provided with a concrete roof with cast iron covers for the manhole and gate rod openings, as well as an opening for the removal of the screens. The low lift pump suctions are protected by fine copper screens, in duplicate, which may be operated and inspected from a floor at their tops.

Distribution Main

A 20-inch discharge main, 9,500 feet long, runs from the station to the new 3,000,000-gallon reservoir. About 3,700 feet from the plant the 18-inch main along Sissons Street is taken off, as previously mentioned. Mannesmann lap welded steel pipe was used for all the pipe work. All the joints, except for the first 125 feet from the station, were of the bell and spigot type and leaded. Immediately adjacent to the plant flanged pipe was used. A Simplex Venturi meter is installed in this section, with indicating and recording apparatus in the generator room. In this room there is also a device which records the water level in the reservoir at any time, with high and low water alarm. In connection with the Venturi charts, the records from these gauges provide a means for not only determining the total draught, but also the draught throughout the day and its variation. The high and low water alarm can also be connected with the City Hall.

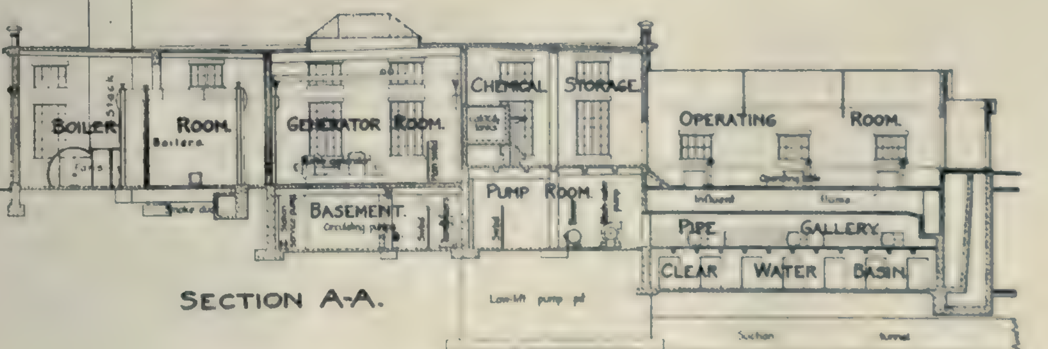


Section through plant, showing pump room and chemical storage.

Constructional Details

The contract for the first construction in connection with this project was let in September, 1912, and the plant was in service about a year later, though scarcely completed. Fyshe, Martin & Company, of Calgary, were the contractors for the power plant, suction wells, intake, etc., and jointly with the New York Continental Jewell Filtration Company, of New York, were contractors for the filters, which were installed and equipped after the filter company's designs. Fraser and Chalmers, of Montreal, supplied the main units, piping and auxiliaries and the high lift pumps. Babcock and Wilcox furnished the boilers, the Green Fuel Economizer Company the fans, and the Gwynne Gas Burner Company the gas burners.

The reservoir was built by Hotson, Leader and



Longitudinal section of plant.

Goode, of Medicine Hat, and the sub-station by Sackrider and Turner, of Medicine Hat.

The construction work of the new plant was carried on continuously during the winter, and in spite of this handicap was very well executed.

By taking the feeder for the city off the rising main at Sissons Street the head on the constant speed turbine pumps is not expected to vary greatly with increased friction in the pipes after they have been some years in service, because, with the same number of units in service, the friction head will probably increase with time from the pumping station to Sissons Street, but, as the draught from the city should be greater with a larger population, the flow from Sissons Street to the reservoir will be less, which will tend to lower the friction head in this section.

Storage Reservoir

The reservoir is a rectangular covered reinforced concrete structure, 96 ft. by 208 ft. by 21 ft. 2 ins. High water is at El. 380.67. One side wall has been designed to be self-supporting with the earth backing removed, so that it may serve as a dividing wall when the reservoir is extended. Keyways and exposed steel reinforcement are left at the ends for tieing in the extension.

The reservoir is provided with the usual piping to ensure circulation and permit of its being washed out. An overflow is provided also. The necessary gates and connections are located in a concrete gate house with a brick superstructure, which is carried beyond the corner of the completed reservoir to serve precisely similar functions for the next extension.

Operating floor of filter room.

The reservoir, like the coagulation basins, has a beam and slab roof and buttressed walls, reinforced horizontally. The design of the walls, slabs and buttresses was based on the assumption that the earth would exert a pressure equivalent to that of a fluid weighing 15 lbs. a cubic foot when the reservoir was full and 33 lbs. a cubic foot when the reservoir was empty. The upper 6 or 8 feet of the walls is necessarily heavier than is actually called for on this basis of design, and is stable enough to stand alone, even if the earth backing were removed, or shrunk away from the wall to this depth. One advantage of this type of wall is that the main reinforcement serves as temperature reinforcement as well, and very effectively distributes any vertical cracks.

The leakage test of this basin was considered very satisfactory. The total leakage in 96 hours was only ¾ inch under about 18 feet head—i.e., less than ¼-inch a day. No special waterproofing was used, and the walls were not plastered. The usual V-shaped horizontal construction joints were used, and at every vertical construction joint the contractor was required to insert a 16-gauge copper strip 10 inches wide with one corrugation at the centre of the joint. These joints were temporarily boxed out into the back-fill to permit of inspection from the outside after the reservoir was filled.

Electrical Distribution

The section in the immediate vicinity of the power house is supplied with electrical energy at 2,200 volts directly from the main station. Beyond this area the supply at the same potential is taken from a sub-station located in the industrial district of the city, about four miles from the generating plant. Transmission is at 13,200 volts. The sub-station is a reinforced concrete building with brick and tile curtain walls and concrete trim. At present it contains three 500 k.v.a. General Electric water-cooled transformers, with the necessary switching equipment. Space is provided for three more transformers, and there is a five-ton hand travelling crane serving the main floor.

In August, 1913, the engineer at the request of the city submitted a report and preliminary plans for a scheme covering the ultimate development of the plant within the limits of the present site. During the preceding year the development of the city had been remarkable, and the very favorable rates quoted consumers for electrical power had minimized the effect the offer of free or very cheap natural gas was expected to have in curtailing the demand on the municipal power plant. Larger sized units were recommended, suitable for a gradual extension of the plant. The ultimate capacities provided for were:—

Filter capacity	30,000,000 gals. a day
Boiler capacity	16,000 h.p.
Turbo-generator capacity .	24,750 kv.a.
High lift pumping capacity	33,000,000 gals. a day
Low lift pumping capacity	55,000,000 gals. a day

The cost of the initial installation was in the neighborhood of $500,000.

Mr. R. S. Lea, M. Inst. C. E., of the present firm of R. S. & W. S. Lea, consulting engineers, of Montreal, was the engineer for all of the work described, which was carried out during the tenure of office of Mr. A. K. Grimmer, Assoc. Mem. Can. Soc. C. E. as City Engineer.

Present-day concentration of business in a small area, stated Prof. George F. Swain recently to the Engineers' Society of Western Pennsylvania in discussing rapid-transit problems in cities, is due to three engineering developments of the last few years; namely, the skyscraper, the elevator, and the telephone. While the development of steel-frame construction for high buildings is what has made concentration of business possible, skyscrapers themselves, he pointed out, would not be practicable without the elevator and the telephone. He cited an investigation made a few years ago by the American Telephone Company as to the relation of the telephone to one of the skyscrapers in New York City. It was found that if all the messages transmitted by telephone to and from the building had to be carried by messengers the entire area of the building would be required for elevators.

Reinforced Concrete as a Building Material

By M. T. Cantell, Lic. R.I.B.A.*

IN view of various statements concerning the advisability of using reinforced concrete for certain buildings which were made before the Public Accounts Committee when inquiring into the construction of the Parliament Buildings, Winnipeg, the following particulars relative to the suitability of this material for general building purposes may be of value to those interested in this class of construction.

Reinforced concrete is a combination of Portland cement concrete and steel, two of the most important materials used for construction. If used separately each has its advantages and disadvantages. If combined, of the right quality and properly proportioned, the resulting material will have the advantages of both and the disadvantages of neither.

Concrete alone has great strength in compression, its crushing resistance when only a month old being approximately 2,500 pounds to the square inch. Its strength increases with age for an indefinite period; whether placed in the air or under water it is practically everlasting; it is one of the best materials to resist heat; if well made it will cost nothing for maintenance; it has perfect sanitary properties, and can be easily moulded to any architectural or engineering forms. Its disadvantages are that it is weak in tension, rarely being able to resist more than 200 pounds to the square inch, and that it lacks ductility. Owing to these defects, it cannot resist the slightest contraction under variations of temperature without developing cracks. Expansion and contraction under variations of temperature take place with concrete as well as with all other materials, although to a less extent than in most others. These cracks entirely destroy the slight tensional resistance the concrete might otherwise offer; consequently, concrete alone can be used only for such structures, or parts of structures, as are in compression. This in many cases necessitates a very large mass of concrete, and consequently a much greater weight and demand on space than is desirable, or at times possible. As an instance of this, take a retaining wall, which if built of plain concrete would need a thickness at its base of approximately half its height, but if built of reinforced concrete the thickness here need not be more than one-twelfth of its height, and perhaps much less, according to the design adopted. Many similar instances could be given. It is obvious, therefore, that a great disadvantage of plain concrete is its bulk and consequent increased cost, weight, and demand on space.

In steel we have a material of great strength in both compression and tension, its ultimate resistance being as much as from 60,000 pounds to 100,000 pounds to the square inch. It is also a material capable of being easily worked or framed into any desired form; but unfortunately its disadvantages outweigh its advantages for many structural purposes. Its strength diminishes with age; this is due chiefly to oxidation, which takes place on exposure to moisture, acids, or general atmospheric action The oxidation is very rapid in structures that are not kept well painted, and it is also very detrimental to the strength of the steel at joints or laps, where it is impossible for paint to be applied. Numerous accidents with great loss of life have been due to this cause. 1-40 inch rust on a bar ¾-inch square will diminish its strength by 13 per cent., or by 20 per cent. on a bar ½-inch square. Another disadvantage of steel is its susceptibility to heat; this it absorbs and conducts rapidly, causing excessive expansion and loss of strength under a high temperature. Steel gains in strength with heat up to a certain temperature, during which time it will expand as much as one-inch in 26 feet. With a continued rise of temperature its strength rapidly diminishes, and its expansion increases proportionately. In ordinary house fires the temperature seldom exceeds 1,000 degrees, but in large buildings it has been known to exceed 2,500 degrees. The expansion, even at 1,000 degrees, causes a stress far beyond the limit for steel at that temperature. Under these conditions the resistance offered by the loads and the fixed ends of steel beams, stanchions and framed structures prevents longitudinal expansion, and causes a stress far beyond what the steel is capable of resisting, especially in its weakened condition. Consequently the beam or stanchion buckles, causing the collapse of the structure. Firemen well know the great risk they run in fighting fires in large buildings in which steel beams and columns are not protected properly. In a recent report made by the Fire Superintendent of the city of London is was stated that this was the greatest danger the firemen had to face.

Newgate Street front of the G.P.O., London, England.

Other disadvantages of steel structures are their high cost of maintenance, and, in certain cases, their unpleasing and fragile appearance, which suggests weakness rather than strength. The latter is particularly noticeable in many of our unsightly, disproportionate bridges, which appear to have been designed for the purpose of obstructing the view or of marring the landscape. It must be admitted, however, that they are useful as landmarks.

In reinforced concrete we have the great strength, toughness, and rigidity of steel, the great durability and fire resisting properties of concrete, the appearance of stability and strength, the steel permanently protected from oxidation, no loss, but an increase of strength with age, a great saving of cost in construction, no outlay for maintenance, and a material adaptable to all forms of architectural and structural work. Since its introduction, experiments have been conducted continuously with a view to obtaining a thorough knowledge of its properties. These experiments, together with the lapse of time and the severe tests to which it has been subjected in existing structures, prove conclusively its absolute reliability for the construction of all types of architectural and engineering structures. It is now used successfully for the construction of all kinds of residences, from workmen's cottages to millionaire's mansions, for small business premises and large skyscrapers, for hotels, churches, theatres, public buildings, hydro-electric power stations, gas works, factory chimneys, reservoirs, aqueducts, water-mains, sewers, grain elevators, bridges, sea defence works, railway works, military fortifications, and numerous other purposes.

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*Author of "Reinforced Concrete."

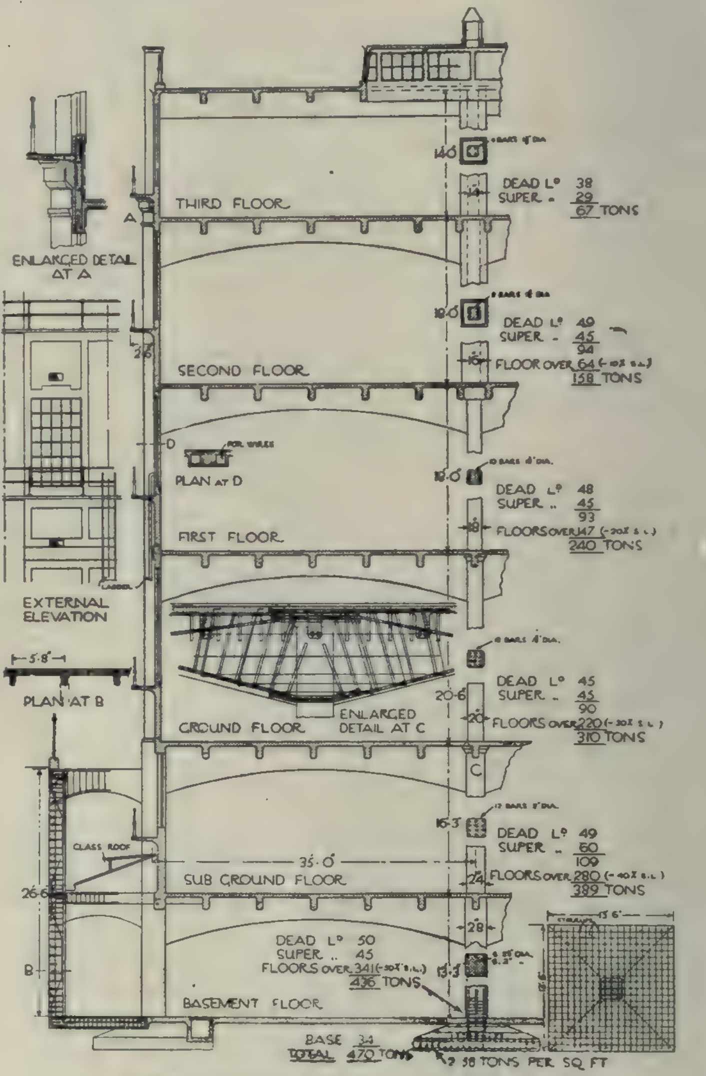
Interior view of the G.P.O., London, England.

In a paper by Mr. M. S. Lang on "Concrete in Railway Work," recently read before the National Association of Cement Users, at Pittsburgh, it was stated that the railways of Canada and the United States found reinforced concrete to be the most durable and economical building material. They were now adopting it for all types of work, including small shop buildings, and even watch-boxes and telephone booths, as these could be constructed of reinforced concrete more cheaply than they could of wood.

It is a method of construction which is fast superseding that of brick, wood, stone, and steel, and is far superior to these in its power to resist water, fire, earthquakes, and atmospheric influence. It is, however, of the utmost importance to bear in mind that of the valuable properties reinforced concrete possesses few will exist if the work is not properly designed and executed. The latter is quite as important as the former, for if the greatest of care is taken with the design and careless supervision is given to the construction the result may be as bad, or probably worse, than if the work were poorly designed. In fact, a poor design well constructed may give a much better result than a good design badly constructed.

The supervision should include careful inspection and testing of all the materials and attention to the preparation, erection and removal of the forms, to the gauge mixing and placing of the reinforcement according to the drawings and specification, to the position and condition in which slabs and beams are left unfinished at the end of a day's work, to the condition of unfinished work before its continuation or completion, to the protection of newly finished work from building operations and inclement weather, and to the testing of work upon completion. All these points are of the utmost importance if we aim at procuring the best results possible. It is absolutely necessary, therefore, that constant and expert supervision be given to the construction.

In designing the chief consideration is strength. This, however, should always be considered in association with economy. This has not been done in the past to the extent it should have been, and the neglect has been very detrimental to the progress of the work. It has given the public the impression that reinforced concrete is more expensive than brick, stone, or steel —which is not the case: its use ensures a great saving of cost on large structures, and also on small ones providing there is sufficient repetition of detail to keep down the cost of form construction. Economy in design, however, has often to be considered from two points of view—viz., the engineering and the architectural; these are not always reconcilable. The most economical engineering structure would have a certain arrangement of beams, slabs, columns, walls, etc., all spaced and proportioned in the most efficient manner, and with a definite percentage of reinforcement, all determined with due regard to the loading, and with a view to obtaining the strongest, most satisfactory, and cheapest structure; but if these engineering points



Sectional elevation of the G.P.O., London, England.

were the only ones considered by the architect the result in some cases would be very uneconomical. The engineering structure may be considered either as a plain mass or as a skeleton framework devoid of architectural embellishments. The architectural structure is the engineering structure made more presentable by the addition of fittings and embellishments.

Economy on the engineering side is purely structural, and in a building it is attained by keeping the floor slabs thin, by a free use of beams or columns, and by keeping the beams thin and deep, and also by graduating the columns in size according to their different loads. This, from an architectural point of view, might turn out to be very economical, as it might involve much more finishing in the way of cornices and other details, and much greater expense to secure efficient light and ventilation, than would be the case if thicker slabs with fewer and more shallow beams were used. Therefore, if we wish to design economical structures we must consider carefully the many factors concerned. The most important of these are the ratio of breadth to depth of beams, the percentage of reinforcement, and the general arrangement or layout of beams and columns. These influence all structures, and should be considered by both the architect and the engineer. The percentage of reinforcement is of the utmost importance. Great waste is often occasioned through an excessive quantity of steel being used. There is a definite percentage that will give the most economical section: it is that which is such as to allow both the steel and concrete to be stressed to their allowable limits when the structure is fully loaded; we then get the full value out of each material. If one of the materials is understressed it means that there is an excess of that material, and consequently a waste.

Many examples from all parts of the world could be given as further evidence of the suitability of reinforced concrete for both small and large structures. The following particulars and illustrations, however, should be quite sufficient to substantiate the foregoing statements.

The view shown below of the new Traymore Hotel, Atlantic City, was taken on March 13th of the present year. This building, which is now complete, is one of the largest reinforced concrete structures in existence. It is 520 feet deep and 140 feet wide on the wings. The centre portion is 17 storeys high. At the time this view was taken only 14 storeys had been erected. It contains 634 guest rooms. The exterior facing is brick, to match the terra-cotta of the old wing, to which it is connected, and which is also of reinforced concrete construction, although built some years ago.

The two following structures—the General Post Office in London, Eng., and the Royal Liver Building in Liverpool, Eng.—were referred to in an article recently published in the Manitoba Free Press, regarding the constructional features of the new $4,500,000 Provincial Government Parliament Buildings at Winnipeg. They are, however, worthy of further notice, together with additional illustrations.

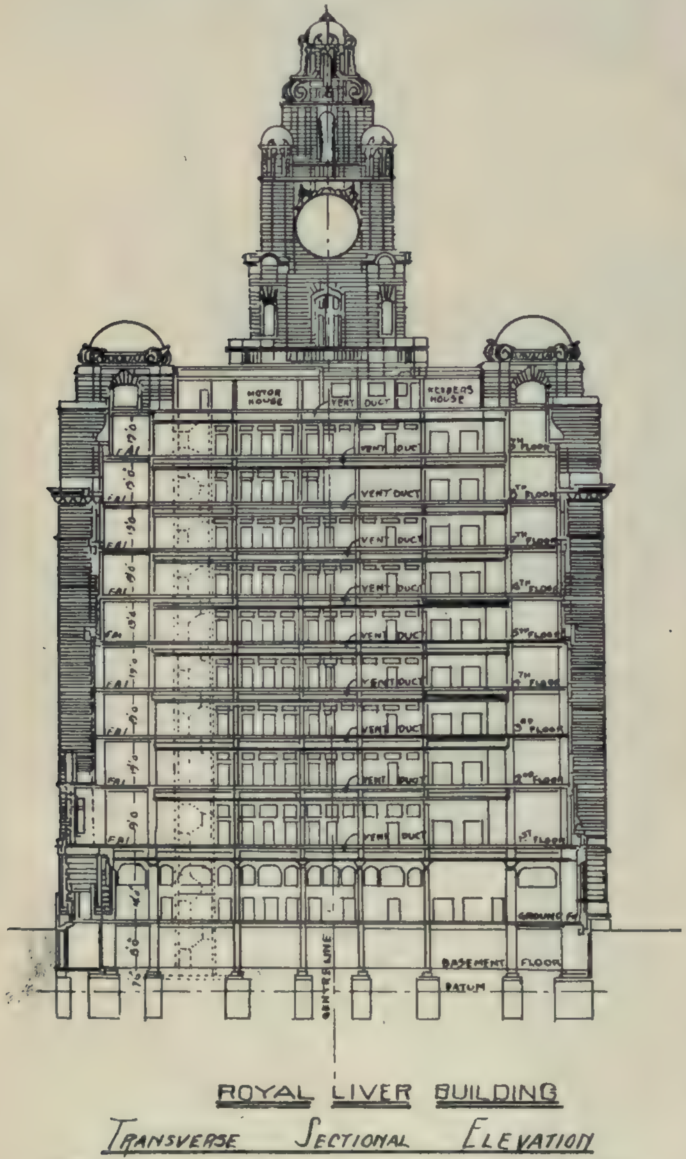
The General Post Office, designed by Sir Henry Tanner, in collaboration with Mr. L. G. Mouchel, reinforced concrete engineer, was completed in 1910. At the time of construction it was said to be the most extensive piece of concrete work in existence. A portion of the building is seven storeys high. The dimensions of the basement are 446 by 210 feet. The total floor area is 467,000 square feet—which is about 10¾ acres. The cubic contents of the building are about 9,000,000 cubic feet. The entire structural details, including foundations, walls, beams, floors, roof, staircases elevator shafts, and a furnace shaft 4 feet 6 inches by 130 feet high are of reinforced concrete. The floors are only 3½ inches thick, and are designed to carry a superload of 100 pounds to the square foot. The external wall panels are six inches thick by 34 feet long between the columns; the internal main columns, each supporting 520 tons, are 28 feet high, and vary in thickness from 7 to 8 inches. The subsoil, upon which the reinforced concrete foundation is constructed, is in part hardpan or gravel overlying clay; the remainder being clay, similar to what we have in this province. No caissons were used. In January, 1911, before the Royal Institute of British Architects, Sir Henry Tanner stated that the entire work was thoroughly satisfactory, and that no settlement had occurred, and in strongly recommending that class of construction he said that by adopting reinforced concrete in preference to steel construction they had effected a saving of over twenty per cent., this being the saving originally estimated, the actual cost turning out to be the same as the estimated cost. **The actual structural work turned out at 4½ cents to a cubic foot of the building,** but owing to the elaborate finish the

Traymore Hotel, Atlantic City.

cost of the whole structure was 15⅜ cents to the cubic foot.

Sir Henry Tanner stated further that owing to their test specimens of concrete showing a treble increase of strength in three years since construction they had installed two 1,300-gallon water tanks and a rifle range on the roof and a heavy conveyor on the first floor without strengthening the structure.

The Royal Liver Building upon its completion in 1910 was considered to be the most imposing example of reinforced concrete work in existence. The height to main roof is over 170 feet. The domes of the two main towers are 295 feet above ground level. The total height from basement floor level to top of towers is 320 feet. There are 17 storeys including six in the towers. The location is close to the River Mersey, on a site formerly occupied by the St. George's Dock. On account of this, the soil was of a soft, sedimentary nature, incapable of supporting any appreciable load.



Sectional elevation of the Royal Liver Building, Liverpool, England.

Consequently, concrete caissons were adopted and taken down to the sandstone formation, which was found at a depth varying from 32 feet to 47 feet below ground level. The caissons are connected to a reinforced concrete raft, upon which are distributed the loads from the columns, walls, etc. The entire structure is of reinforced concrete, with a granite facing. This facing, however, is not a structural detail; it is supported at each floor level by the reinforced concrete frame. The designing involved unusual and difficult constructive problems, necessitating beams for spans of from 50 to 60 feet, to carry 1,600 tons concentrated at two points in addition to a distributed load of over 100 tons, as well as columns to support loads of 1,600 tons. I understand that the whole work has proved entirely satisfactory, and that the building is a striking monument to the possibilities, advantages, strength and economy of reinforced concrete.

The Royal Liver Building, Liverpool, England.

Dynamite cartridges should never be broken in two, according to the "DuPont Magazine." This dangerous practice is forbidden by law in many countries. Hardly a winter passes without some blaster being killed by breaking a dynamite cartridge. When the dynamite must be exposed, the cartridges should be slit lengthways with a sharp knife. Another dangerous practice indulged in by many rock men is that of carrying matches in their clothes for lighting their pipes, blasting fuses, etc. Instances are on record of an entire loading gang being killed from an explosion caused by dropping a match from one of the men's pockets into the hole, causing the blast to go off while it was being tamped. If fuses are lighted with matches, one man should have charge of them and leave them at a safe distance while loading the hole.

A steel flat-car for whales has been built for the South African Railways by the Leeds Forge Company, of Leeds, England. As described in London "Engineering," the car has a capacity of 160,000 lbs., and the weight of the car itself is 74,700 lbs. The most remarkable thing about the car is that, although it is designed to run on a narrow-gauge road of 3 ft. 6 in. gauge, the width of the car body is 12 ft. 6¼ ins. The whales are brought to port near Durban, South Africa, and are loaded on these special cars for haulage to a factory a few miles away, where they are cut up for rendering. It is evident that cars of such extraordinary width could not run in general traffic on account of clearance limits, even on standard-gauge lines. Their use on a narrow-gauge road shows the possibilities in increasing the width of rolling stock where clearance restrictions do not apply.

The Economics of Sewage Filters

SEWAGE filters may be divided broadly into three classes: (1) Intermittent sand filters or their equivalent. These consist of a body of sand or fairly pervious material of other kinds. The sewage is distributed over the surface of this porous material, and at the bottom the filtered sewage is collected in underdrains. In order to get the benefits of oxidation in the pores of the sand bed, the application of the sewage to the filter is intermittent, with periods of rest and aeration.

(2) The second type is the so-called "contact" filter. This consists of a body of practically any thickness of stone or equivalent material, such as large-sized gravel, pieces of porcelain, brickbats, cinders, or almost any coarse-sized granular material. The sewage is applied to such a filter either from the bottom or from the top, so as to fill the bed. The sewage is allowed to stand in this filter bed for a given time. It is then discharged and the empty bed is allowed to stand for a period.

(3) The third type is the so-called "sprinkling" filter. This consists of a body of stone of a minimum depth of 5 ft., on which the sewage is sprinkled or sprayed and spread by nozzles and distributed in small quantities so that the sewage trickles down over the stones and is collected at the bottom.

All three types of filters effect the purification of the sewage in the same way. Through the action of the bacteria present in the filter bed the sewage is to some extent oxidized and the organic matter is broken up. Unstable forms of matter are changed into more stable forms. While the exact form of action is unknown, it is believed that the three types of filters act in the same way, and the difference is rather a mechanical one of form of application, rather than one of principle of action.

Performance of Filters.—The output of a filter of any type, measured at any suitable purification unit, is largely a question of local conditions. It depends upon the nature of the sewage, the nature and fineness or coarseness of the filtering material, the method of application of the sewage to the filtering material, temperature, atmospheric conditions, and many other factors. The intermittent sand filter is best used when it is desired to have a very high degree of purification. The other types, the contact filters and sprinkling filters, are used for a rather lesser degree of purification. It is to be understood that the rate of application of the sewage to the various types of filters must be properly proportioned to the ability of these filters to take care of the sewage. By using a suitable rate under suitable conditions any type of filter can be made to give any degree of organic purification that may be desired.

Rate of Application of Settled Sewage to Filters.—The question of the rate of application of sewage to a sand filter is largely tied up with the question of preliminary treatment in the way of tankage or screens. The writer's book, "Sewage Disposal," gives for several cities in Massachusetts the population whose sewage can be treated per acre of filter bed, and the time of detention in preliminary sedimentation tanks, sortage wells, pump wells, or other means of storage. These figures are not to be taken to represent present conditions.

	Period of Detention, hours.	Population per acre of filter.
Andover	1½-3	950
Brockton	12	1,160
Clinton	12	425
Framingham	12	375
Gardner (old)	1½	1,310
Gardner (new)	1½	2,000
Pittsfield	12	605
Stockbridge	8	220
Worcester	1½	1,390
Average of all	6.7	937

The Baltimore Sewerage Commission in 1906 estimated that, using a sand filter with 3 ft. of clean sand over the gravel, an allowance of 150,000 gals. of 6-hour settled sewage per acre in 24 hours, corresponding approximately to 1,200 people per acre, would be a proper rate.

Data for contact filters are relatively scant from American practice, and while many English data are available, the differences, owing to the difference in the strength of the sewage, makes such data rather dangerous as a basis of comparison.

A series of experiments in Columbus, Ohio, indicated that 5-ft. deep stone filters, on the contact principle, could safely be operated at an average rate of from 600,000 to 700,000 gals. per acre per day. Reducing this to a 4-ft. depth will give about 500,000 gals. per acre per day, which, on the basis of 100 gals. per capita per day, would give a loading of approximately 5,000 people per acre of stone bed.

A series of tests made at Lawrence on contact beds of various depths from 24 ins. up to 18 ft., showed an average output of some 700,000 gals. per acre per day for a depth of stone on an average about 5½ ft. This is equivalent to an output of about 135,000 gals. per acre for each foot of depth of stone, or, for a 4-ft. depth of bed again, is equal to about 500,000 gals. per acre per day, or say a loading of about 5,000 people to the acre.

The contact filter installation at Plainfield, N. J., with 3.6 acres of stone bed 4½ ft. deep, gave in 1910 an output on an average of 1,700,000 gals. of sewage a day. On the basis of an allowance of 100 gals. per capita per day, this will correspond with a 4-ft. bed, to about 4,200 people per acre of filter.

For sprinkling filters much more satisfactory data can be had. Sprinkling filters have been used very extensively in this country of recent years, and their ratings can be fixed with a good deal more dependence than is the case with contact filters. A list of a number of plants or projected plants giving the depths of the stone bed of a sprinkling filter and the loading in population per acre follows:

	Depth of stone in feet	Population per acre of bed
Atlanta	6	20,000
Reading	5	18,000
Columbus	5	18,000
Baltimore	9	20,000
Montclair	7½	15,000
Philadelphia	6	20,000
Fitchburg	10	20,000
Mount Vernon	8	24,000

The average of all these shows a 7-ft. deep bed and an average loading of 19,400 population to the acre.

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* Paper by Mr. George W. Fuller, presented before the annual convention of the American Society of Municipal Improvements.

Not considering special conditions, and just taking fair figures, we may safely state the following:

Intermittent sand filters, 3-ft. bed of sand, loading 1,000 population per acre.

Contact filters, 4-ft. depth of stone, loading 5,000 population per acre.

Sprinkling filters, 7-ft. depth of stone, loading 19,000 population per acre.

The rates of loading, then, for these three types of filters, are in the ratio 1, 5, and 9.

Cost of Sewage Filters.—Costs of construction are so much affected by local conditions, such as the amount of excavation necessary, the cost of various classes of materials, the distance from which various classes of materials must be obtained, details of local construction conditions, such as competition, class of work required, and others, that comparative costs for different localities are only to be used with great discretion, and individual cost and even averages are only a guide to comparative costs in various places. Having this limitation in mind, we will examine in a rough way the cost of various types of sewage filters on the per capita basis.

The average cost of the nine Massachusetts intermittent sand filters cited above is $3,260 an acre, as reported in the Massachusetts State Board of Health Report of 1903. This gives a cost per capita connected to the filters of $3.50.

The 1906 Baltimore Sewerage Commission estimates the cost per acre of filters at $6,350, these filters being suitable for a connected population of 1,200 to the acre. This corresponds to a per capita cost of $5.30.

The cost of contact filters, varying, of course, with the degree of the fineness of the design, may be taken, for filters equipped with suitable convenient appurtenances, at $30,000 an acre for a 4-ft. deep bed. This corresponds with a loading of 5,000 population per acre to a per capita cost of $6.

For sprinkling filters 7 ft. deep the cost will be about $45,000 per acre. On the basis of a loading of 19,000 population per acre, the cost per capita will be $2.37.

When considering the relatively low cost of the Massachusetts sand filters compared with the estimate made of the Baltimore sand filters, it is to be borne in mind that the conditions in Massachusetts for the construction of sand filters were unusually favorable and do not represent average conditions through the country. In most places the costs would approximate more nearly those estimated for Baltimore.

Taken in a broad way, sprinkling filters are a far more economical installation in the matter of first cost. Intermittent sand filters and contact filters do not stand far apart in this particular.

Relative Costs of Different Depths.—There is not very much known about the relative advantages of filters of shallow or deep construction. The choice of depth is usually made for entirely different reasons from those of obtaining the most economical construction to obtain the desired amount of purification. Very few tests of a comparative kind have been made to give convincing information, and the interpretation of the tests has not been uniform. In some places the conclusion has been made to make filters, say, 10 ft., at other places 6 ft., and some study is worth while to determine what, if any, difference there is in the cost of such construction at different depths, and which would appear to be the better. It is to be assumed in such comparisons that sufficient head would be available in any case for the greatest depth to be considered, and that pumping would not be necessitated by building filters of the greater depth.

For intermittent sand filters questions of depth do not arise. The filters are generally made as shallow as is consistent with getting proper results, and sand beds are not usually made more than 4 or 5 ft. deep as a maximum. Shallower beds, even, will give about the same output as the deeper beds, and beds are made deep only so that sand may be removed for cleaning without removing the sand for any considerable period.

With contact filters it is recognized that from the nature of the action of the contact filters, where the amount of air that is drawn in between fillings of sewage is practically equal to the volume of the sewage, and where surface clogging cannot be a serious factor and may even be no factor at all, each unit of volume of the stone forming the filter, say each cubic yard, will give the same output of sewage purification, no matter what may be the depth of the filter.

From this it follows that it is economical to build a sewage filter on the contact principle as deep as local conditions of construction will permit, and the limitation of depth which it is economical to use is therefore made by the factors of earth excavation or fill and the possible head available without pumping.

When it comes to sprinkling filters the problem becomes a little more complicated. The English experience, as recited in the Report of the Royal Commission, seems to indicate that the output per unit of volume of sprinkling filters is the same, no matter what the depth. Our experience in work in this country does not wholly corroborate this information. Our best knowledge seems to indicate that the output per unit of volume of sprinkling filters is somewhat less for deep filters than for shallow filters. For such conditions, with a relatively decreasing efficiency of the stone of the filter beds for greater depths and at the same time a relatively decreasing cost per unit volume of the stone for deep beds, there must come some point where the greatest output per unit of cost will be obtained.

The Report of the Baltimore Sewerage Commission for 1911 gives some information obtained from tests made in Baltimore as to the relative efficiency of various depths of broken stone of sizes of 1 to 2-in. stone, which is the one most commonly used. Figures obtained from that source are as follows:

	Depth of Bed.		
	6 ft.	9 ft.	12 ft.
Relative stability	79	87	89
Per cent. reduction of oxygen consumed.	56	70	72

Giving equal weight to the relative stability and per cent. reduction of oxygen consumed, we get the following:

	Depth of Bed.		
	6 ft.	9 ft.	12 ft.
Relative stability	1	1.2	1.23
Per cent. reduction of oxygen consumed.	1	1.25	1.28
Average of the two	1	1.22	1.25
Relative depths	1	1.33	2.00
Relative value of stone per cubic yard ...	1	.92	.63

Assuming that this depth varies at a uniform rate from one end of the curve to the other, we get the following for the relative value of stone per cubic yard:

Depth of bed in feet ...	6	7	8	9	10	12
Relative value of stone per cubic yard	1.0	0.97	0.94	0.92	0.82	0.63

To get comparative figures, then, between the 6, 8 and 10-ft. beds the cost figures for the 8-ft. beds must be divided by 0.94, and the cost for the 10-ft. beds by 0.82, putting them all on the basis of the 6-ft. beds.

For comparative cost a number of factors, such as excavation, etc., are naturally omitted, as they are not affected in all places in the same way by the depth of the filter. Comparing, then, only those particular costs which are affected per unit of output by the depth of the filter, we get the following:

	Per effective cu. yd. depths. 6 ft.	7 ft.	8 ft.
Floor—Take at 40c. per cu. yd. for a 6-ft. bed	$0.40	$0.35	$0.32
Tile—Take 11c. per sq. ft. for any depth	.49	.44	.40
Walls—Assume cost 17c. per cu. yd. for 6-ft. depth	.17	.17	.18
Galleries and Collectors—Assume for 6-ft. depth 25c. per cu. yd.	.25	.22	.20
Distribution—Assume 50c. per cu. yd. for 6-ft. depth also. As costs theoretically vary only according to quantity delivered, they must be same for all effective depths per cu. yd.	.50	.50	.50
Stone—Assume $1.50 per cu. yd.	1.50	1.55	1.60
Total	$3.31	$3.23	$3.20

Outside factors will depend on quantity only, and not on depth.

It appears, then, that there is some slight saving of cost, which, on the figures given in the above tabulation, amount to about 3 per cent. in favor of the 8-ft. deep bed as compared with the 6-ft. deep bed. On the other hand, it is to be recognized that a deep bed will give a good deal more trouble with pooling and freezing than a shallow bed, and the advantages in favor of a shallow bed due to this lesser amount of pooling will be considerably more than this 3 per cent. difference in cost. Taking everything into account, the writer believes that a sprinkling filter of not less than 6 ft. and not more than 7 ft. in depth will in the greater number of cases prove the most economical to use.

Comparative Costs of Trench Sheeting

By Richard T. Dana*

FOR sheeting those of the trenches under consideration which were excavated by the steam shovel, Wemlinger sheet steel piling, section 2a, No. 12 gauge, was purchased, the intention being to drive the sheeting ahead of the shovel with a McKiernan hammer, and excavate on the inside. As the operation of the shovel was not economical, this plan was abandoned, and the sheet piling was used in the hand dug trenches, together with the lumber purchased for that purpose.

Extensible steel trench braces were used chiefly, but sometimes wooden braces, either cut from the woods or made of broken ranges, were employed.

The cost of sheeting the sides of a trench per linear foot depends on (1) the closeness of the sheeting—that is, whether the sections or planks are driven close together or spaced varying distances apart; (2) the skill of the workmen; (3) the urgency of the work; (4) the hardness of the material; (5) the depth driven; (6) the method of driving; (7) the kind of sheeting, whether wooden or metal; and (8) the kind of bracing.

In cases of badly caving banks or running sand absolute continuity of sheeting is necessary, but where the banks are firm, even though the trench be deep, the sheeting need only be used as a safety measure and the sections placed 3 ft. or more apart.

The most intelligent men should be chosen for the sheeting, as a single bad cave-in may wipe out the profit on a job and cause serious injury or loss of life. The head sheeter should be an active man, while his helper should be a heavy, strong laborer. Their pay should be more than that of the pick and shovel men. In trenches of this character the sheeters are seldom worked to their full capacity, as work of this kind requires a certain minimum number of men and their day's work depends on the performance of the rest of the gang. Therefore the costs given in the tables do not, in most cases, truly represent the minimum cost.

Where the material is hard and strong metal sheeting penetrates more readily than wood, and in running sand or water the lap and clips on the metal sheeting make it very efficient in keeping the trench clear. However, the first cost is greater, and on work of short duration it is not economical, unless the sheets can be used on another convenient job or sold advantageously. The weight of a square foot of this section is about 7½ lbs., which makes it more difficult to handle than the wood planking 2 ins. thick, which weighs about 5 lbs. the square foot. Steel extension braces are invariably more economical than wooden braces when the trench is narrow; the cost of placing them is much less. Wooden braces require measuring, sawing, and wedging, while the same jacks may be used on several different widths of trench.

Some thirty sets of observations were made and separated into two classes—close and spaced—each of these being divided into three classes—mixed, wood, and metal—for sometimes the wood and metal sheeting were used in the same trench as they came to hand. The rate of pay for sheeters was about $2.50, and that of the helpers about $2. Other labor received about $1.65. Overhead charges have been taken account of by including one-eighth of the pay of foreman and waterboy, which were $4 and $1 a day respectively.

Cases 7, 8 and 9 give the cost of removing the sheeting. Case 9 is peculiar. This occurred in sheeting a trench through loose sand in which a 42-in. concrete sewer was to be laid. The metal sheeting was driven about 6 ins. below the bottom of the trench, and after being oiled was used as the outside forms for the concrete sewer. When the concrete had set and the trench had been backfilled within 2 ft. of the top, the sheeting was withdrawn. A large wooden tripod with a differential block and tackle operated by two men had to be used for pulling the sheets. The average time for pulling one sheet on the day the third observation was made was 9 min. 53.3 sec., made up of the following items:

Item	Min.	Sec
Loosening with mallet	..	18.6
Moving along chain hoist	..	40.0
Lowering hook and chain on hoist	..	43
Placing hook on sheeting and starting to pull	1	14
Raising sheeting	5	30.5
Removing hook from sheeting and putting sheeting aside	..	44
Miscellaneous	..	43.2
Total	9	53.3

Sheeting being on both sides of the trench, and two pieces of sheeting being equal to 1 ft. of trench, the time for each foot of trench was 19 min. 46.6 sec.

The number of feet of trench from which the sheeting was removed each day was about 30.4. The cost was as follows:

2 laborers, at $1.65	$3.30
⅛ foreman, at $4	.50
⅛ waterboy, at $1	.13
Total cost per day	$3.93

Cost per linear foot (30.4 ft. removed), 12.9 cents.

In case 8 the foreman and waterboy are not

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*Consulting Engineer, New York City.

Table 1—Sheeting Trench—Unit Costs and Other Data, for Wood, Metal and Mixed Sheeting, When Solid and When Separately Spaced

No. Obs.	Unit cost, cents Lin. ft.	Unit cost, cents Sq. ft.	Trench depth, ft.	No. men	Equivalent 10-hr. perpormance, lin. ft. of trench	Remarks
Case 1—Mixed Sheeting, Solid						
1	7.23	0.344	12	3	91	Sandy
2	8.00	0.620	6.5	4	100	Material caves badly
3	8.30	0.670	6.5	4	100	Clay and sand
4	8.61	0.480	3	2	60	Soil, poor sand
5	9.50	0.530	9	2	55.7	Soil, poor sand
6	10.50	0.704	7.5	4	80	Soil, clay gravel
Average	8.69	0.558	7.4.	3	81.1	
Case 2—Wood Sheeting, Solid						
1	7.80	0.390	10	3	98	Material sandy
2	8.00	0.450	9	2½	67	Clay material, some sand
3	8.55	0.710	6	3	75	Clay gravel
4	14.80	0.930	8	3	63.3	Very sandy; sheeting 8 ft. x 8 in. x 2 in.
5	14.90	0.530	14	2	36	Soil, a poor sand
6	19.50	1.150	8.5	3	31.4	Soil, sandy
Average	12.26	0.693	9.25	2.7	61.8	
Case 3—Metal Sheeting, Solid						
1	9.10	0.350	10	2	62.5	Soil very sandy
2	9.40	0.360	13	2	61	Soil very sandy
3	9.60	0.368	13	2	60	Soil very sandy
4	11.00	0.610	9	3	70	Soil good sand
5	16.00	0.755	11	3	44	Soil sandy
6	18.50	1.020	9	4	54	Sand tending to cave in.
7	22.40	1.250	9	3	37½	Good sand
8	24.30	1.520	8	3	38½	Very sandy, caving
Average	15.0	0.779	10.25	2.7	53.4	
Case 4—Mixed Sheeting, Separately Spaced						
1	4.78	0.240	10	2	125	Soil a poor Sand
2	6.54	0.356	9	4	100	Soil clay and gravel
Average	5.66	0.298	9.5	3	112½	
Case 5—Wood Sheeting, Separately Spaced						
1	4.20	0.320	6.5	2	88½	Sections spaced 3 to 6 feet apart.
2	4.40	0.244	9	2	129	Soil poor sand
3	5.20	0.290	9	2	15	
Average	4.60	0.284	8.17	2	77.5	
Case 6—Metal Sheeting, Separately Spaced						
1	1.90	0.150	6.5	2	194	Sections far apart
2	3.10	0.195	8	2	162	Sections far apart, clay and sand
3	3.12	0.169	9.3	2	180	Sections far apart, clay and sand
4	4.06	0.232	9	2	137	Sections far apart, clay and sand
Average	3.04	0.186	8.2	2	168	

Table 2—Removing Sheeting—Unit Costs and Other Data for Wood and Steel Sheeting, Solid

No. Obs.	Unit cost. cents Lin. ft.	Unit cost. cents Sq. ft.	Trench depth, ft.	No. men	Equivalent 10-hr. performance, lin. ft.	Remarks
Case 7						
1	0.32	0.024	6.5	2	11.61	Wooden, spaced 3 to 6 ft. apart.
Case 8						
1	1.1	0.042	13	2	3.00	Wooden sheeting blocked partly with wood and partly by jacks. Sheeting, solid. Soil a clay and poor sand. In unit costs given only direct labor is taken account of, i.e., foreman and waterboy are not included.
2	1.6	0.062	13	2	2.50	
3	2.2	0.084	13	2	1.50	
4	2.5	0.096	13	2	1.66	
5	2.6	0.100	13	4	2.50	
6	2.7	0.135	10	2	1.25	
7	2.7	0.135	10	4	2.50	
8	2.8	0.140	10	2	1.25	
9	3.3	0.137	12	4	2.00	
10	3.5	0.175	10	2	1.08	
11	3.6	0.180	10	2	0.94	
12	3.9	0.177	11	2	0.83	
Average	2.7	0.122	11.5	2½	1.75	
Case 9						
1	5.6	0.311	9	2	0.70	Sheeting, steel, filled in to a depth of about 6 ft. before pulling. Used a differential block and tackle. Overhead charges. ⅛ foreman and ⅛ waterboy included.
2	12.5	0.695	9	2	0.31½	
3	12.9	0.718	9	2	0.30	
Average	10.3	0.575	9	2	0.44	

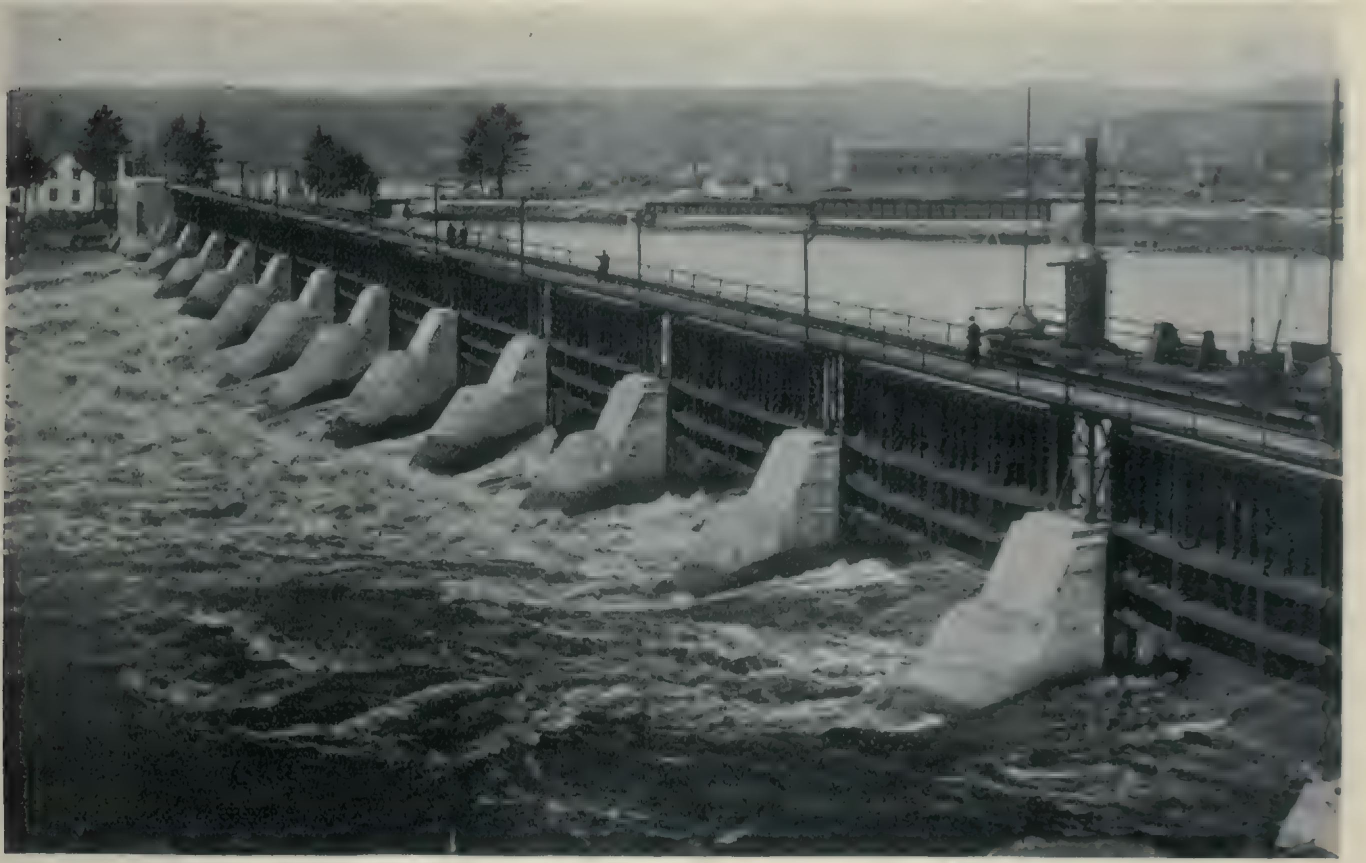
charged. If this were done the average cost would be about 3.2 cents.

At the beginning of the season 400 pieces of Wemlinger piling 10 ft. long and about 5,000 ft. b. m. of 2 x 8-in. longleaf yellow pine were purchased. The steel piling cost 28 cents a superficial foot, and the lumber cost about $34 a thousand. This does not include the timber rangers which were used for both steel and timber sheeting.

At the end of the season there remained 1½ dozen planks and some 20 ranges, all of the Wemlinger piling and all of the iron braces. The timber had been stolen, broken, burnt, or otherwise wasted, or in a few cases used for other purposes. During the summer the steel sheeting was repeatedly used for roadways in and out of sand pits and wherever the hauling was bad. During the fall and winter it was used to heat the concrete for the buildings under construction, the sections being laid at an angle of 30 deg., so that one end rested on the ground and the other on a wall of building blocks or brick. Some of the wooden sheeting, in spite of hard usage, remained in fit condition to be used many times, and in fact seemed almost indestructible.—Engineering Record.

Regulating Gates at Shawinigan Falls, Que.

THE accompanying illustration gives a general view of one section of a movable steel dam built for the Shawinigan Water and Power Company at Shawinigan Falls, Que. This dam consists of two portions, as the river is divided into two channels by an island. One portion consists of eight gates, and the second portion, which is the one illustrated, consists of twelve large and two small gates. All the large gates are 40 ft. wide in the clear between piers, 18 ft. high, and 21 ft. lift. The small or regulating gates are contained in the gate house. They are 16 ft. wide and 18 ft. high, with 21 ft. lift. The large gates are lifted by means of travelling hoists which run along the bridge, which is supported by towers on the masonry piers. Hoisting is done by means of screws which connect with the vertical end girders of the gates. When lifted to their highest position, the gates are sustained by being connected directly to the bridge through locking pins, which are operated by a hand lever from the platform of the hoist. The hoisting screws may be disconnected and the machine used for lifting other gates. In the illustration all the gates are lifted to their highest position. Two hoists are provided for the 12-gate section of the dam, and one hoist for the 8-gate section, all of which are operated electrically. The boiler shown in the illustration on the platform of the hoist is used for freeing the gates of ice when this becomes necessary. The small gates in the gate house are provided with individual screw hoists of a type similar to those mentioned.



Section of a movable steel dam built by the Dominion Bridge Company, for the Shawinigan Water and Power Company.

Connecting a Suction Tunnel

IMPROVEMENTS made to one of the pumping stations of the Chicago Water-works included the construction of a suction shaft and tunnel and the connection of the latter to a wet well in use. Engineering and Contracting published the description of the methods of handling the work from the annual report of the engineer of water-works construction, Mr. H. W. Clausen.

The construction of a suction shaft and tunnel and the connection of the latter to a wet well in service were special features involved in the improvements made in 1913 to the Springfield Avenue Pumping Station of the Chicago Water-works. The present article describes the method of handling this work.

The work was made necessary by the installation at this station of a new Allis-Chalmers 25,000,000-gal. turbine-driven centrifugal pump. The city provided the foundations for the pump and also the suction shaft and tunnel to a connection with the wet well which supplies the four other pumping engines in operation in this station.

The method employed for the connection of the new suction tunnel to the station wet well consisted in placing a curved cast iron shield in the wet well. The edge of this shield was grooved and fitted with a 2½-in. rubber fire hose, acting as a gasket to permit a water-tight connection between the shield and the masonry wall of the well. On the upper end of the shield were two flanged connections, one for the 8-in. pipe extending to the level of the gallery on the top of the wet well at an elevation plus 8, and the other for a 24-in. pipe extending to a point just below a 24-in. horizontal suction pipe, which supplemented the main suction of old pumping engine No. 4. It was expected that the head of water caused by pumping the water out of the shield through either one of these pipes would give a pressure sufficient to hold the shield in place. The empty space between the shield and the wall would then give opportunity for making a connection between the old brick masonry of the well and the new concrete lining of the tunnel.

The material underlying the foundations and pit floor of the pumping station is solid rock. It was therefore necessary to blast out the shaft and tunnel. The foundations of engines previously erected, between which the shaft and tunnel were built, are 20 ft. apart, and rest directly on the rock. Both of these pumping engines were to be kept in continuous operation, and extreme precautions were necessary.

Work was started at the station on May 12. The excavation for concrete footings for the pump and discharge pipe pier was carried to rock at an elevation of about minus 20.5. The rock was cleared with picks to a level surface to minus 21.75. The foundations were erected of 1:2:4 concrete. Forms were made of 2-in. lumber, and bolted together so that they could be used for similarly designed foundations elsewhere.

Drilling for the shaft blasting was started by hand on May 20, and by machine on May 31. The work of drilling, blasting and mucking was carried on from May 22 to July 8. Two hundred and ninety 1 x 8-in. sticks of 60 per cent. dynamite, and 568 electrical exploders, were used on this part of the work. The blasting was stopped at a point 5 ft. from the interior surface of the well, leaving 2 ft. of rock and 3 ft. of masonry to be taken out. About 80 holes 12 ins. deep were drilled in the face preparatory to the work of removing the last 5 ft., which was to be done after the placing of the tunnel shield.

The tunnel shield was made of cast iron, approximately rectangular in shape, about 8 ft. 7 ins. high. 6 ft. 9 ins. wide, and 3 ft. through. The casting was made in the foundries of the American Brake Shoe and Foundry Company. The hose gasket was a piece of condemned fire hose with the usual canvas lining, and was filled with a special preparation, called "chemical rubber," which is being used as a filler for automobile tires. The gasket was held in place with T-headed bolts, the heads of which were inserted in the lining, the shanks extending through to the outer surface of the groove, where they were held in place with nuts.

On August 27 the shield was lowered into the well, with the 24-in. spiral pipe attached, using the station crane. It was suspended from two 1¼-in. cast steel locomotive cables, which in turn were suspended from two 3-ton chain falls. These were suspended from 6 x 8-in. timbers supported on the gallery and upper edge of masonry of the well.

A No. 4 drive well jet pump, with 1-in. steam supply, was placed inside of the shield, with the bottom at elevation minus 32, the discharge passing up over the top and down the side of the well, and discharging at about elevation minus 13. The suction of a No. 3 Blakeslee bilge pump was also lowered into the shield through the 24-in. pipe.

The two pumps, with a combined capacity of 83 gals. a minute, did not lower the water inside the shield sufficiently, proving that a larger pumping capacity was necessary to force the shield and gasket tight against the masonry wall.

A No. 2 double-cylinder Emerson pump was added on September 3, placed in the wet well, and connected to the steam line. The 3-in. suction of this pipe was let into the 24-in. pipe. The operation of this pump produced the desired effect of tightening the shield, emptying the same to the limit of the suction in about five minutes. The shield proved to be tight on September 8, and the blind flange was placed on the 24-in. pipe leading up from the shield. This was necessary, as the water level in the well was above normal, pumping engine No. 4 having been shut down. Consequently the deep well jet pump, which was operated intermittently, took care of all the leakage. The leakage was steadily reduced, requiring about 2 minutes of pumping every 15 minutes at first and 20 seconds of pumping every 20 minutes toward the completion of the work.

The plans for the installation of the centrifugal pump provided for a 36-in. hydraulically operated gate valve, to be placed in valve pit just below the floor level of the main engine pit. The shaft and tunnel were lined to an average thickness of 6 ins. with 1:2:4 concrete and the valve placed and connected, giving an additional safeguard in the event of an accident occurring.

The first foot of rock of the two remaining was mined out by blasting, using 19 sticks of dynamite in 62 of the holes previously drilled. The rest of the rock and the brick work, varying from 3 ft. to 4 ft. in thickness, was mined by drilling holes and breaking out material with bull points and sledges. All mining was completed by September 17.

The remaining portion of the tunnel was then lined with concrete of minimum thickness of 4 ins., the average thickness being 8 ins. The lining was completed on September 18. Forms were removed and water admitted into the tunnel on September 22. The emergency pump, tunnel shield, and concrete chute were then removed from the station. The wet well cover and railing were replaced, and the interior of the station cleaned up.

New Connaught Library at Victoria, B.C.

THE new Provincial Library addition to the Parliament Buildings at Victoria was practically completed several months ago, but owing to delay in the arrival of some of the interior fittings the building was not ready for occupancy until June 10th.

The Library, the corner-stone of which was laid in August of 1912 by His Royal Highness the Duke of Connaught, is a handsome building and a worthy addition to the block of legislative structures of which British Columbians are justly proud. It faces on Superior Street, is immediately behind the legislative wing of the existing building, and, although of a somewhat different style, is in harmony with it. The block stands three storeys high from the Superior Street frontage, with a high basement. In niches below the tops of the corner towers are full-length statues of men prominent in the history of the province since its Crown Colony days, and above are several symbolical figures.

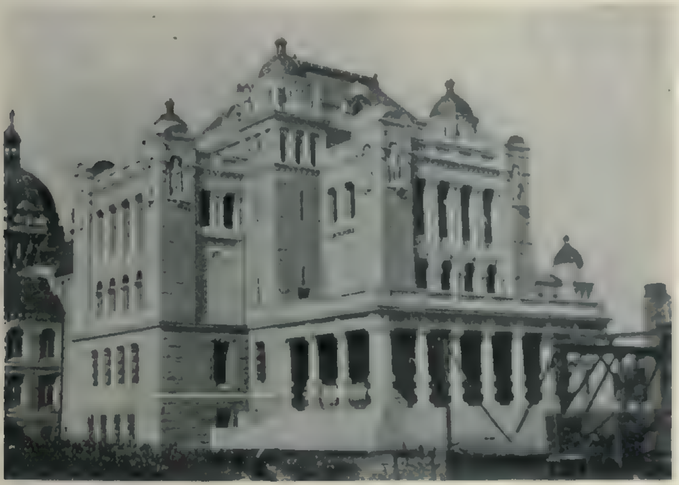
The main portion of the Library is on the same floor as the Legislative Chamber, and is approached from the lobby of the house by a wide corridor which occupies the place of the old rear entrance stairs. The office of Librarian E. O. S. Scholefield is to the right, and that of his assistant to the left, before the rotunda is reached. The rotunda runs up through two storeys, and is domed, with gallery openings on the second floor. It is octagonal in form, with columns in pairs at each side of the four openings, and the walls panelled in marble. The veining of the marble corresponds in all four walls. At the base of each is a wide marble pedestal for statuary. The floor is of marble tiles in color.

Mahogany Finishings

On the west side of the rotunda is the reading room, and on the east is the reference room. Both are finished in mahogany, are high-ceilinged and spacious, and admirably adapted to their uses. In the reading room is a quantity of exquisite carving in holly, which will harmonize with the darker background when it has weathered somewhat. This was executed at Cheltenham, England, and is a triumph of the wood-carver's art. Interlaced in the patterns are animals, birds, flowers and fruits of the province. Over the mantel there is a festoon of this carving, and other bits are placed on the upper halves of the pilasters around the apartment. The fireplace in the reference room is built in hearth style, and the mantel is carved in simple designs.

The delivery clerk's desk is on the south side of the rotunda, and immediately behind it are the stackroom and the dumb-waiter which communicates with each storey of the six in the stack. The furniture in all the rooms is of mahogany, upholstered in dark green leather, and the whole atmosphere is conducive to reading and study.

At the head of the stairway, on the second floor, are a couple of small rooms for students. The archives department is given a large room on the east side; and on the west side, over the reading room, is a similar room for the housing of the splendid collection of material on the discovery and history of the Pacific North-West which has been diligently collected by Mr. Scholefield. On the south side, on top of the stackroom, is the map room. In floor cabinets in these rooms will be displayed, under glass, books, documents, letters, diaries, and other papers which can be exposed to the light without danger, and these will be so illuminated as to give a clear view of them.



Main portico of the library.

On the ground floor is the cataloguing room, and in the basement are quarters for the travelling libraries department. The public entrance to the library is on the east side of the block, in the corner where the block joins the legislative wing of the main building. A passenger elevator adjoins the entrance.

The stackroom occupies the south portion of the building from the basement up to the top of the main floor. The shelves are of steel, and are so placed that every inch of space is utilized, while ample room is given for the handling of the books and newspaper files. The whole structure is as nearly fireproof as possible.

The lighting of the building is perfection. There are plenty of windows; the light streams in from three sides with nothing to block it, and future building plans will not interfere with this abundance of natural light.

Marble work in the rotunda.

Variations in the Cost of Track Concreting

By S. Gausmann

THE following costs of concreting in connection with paving between modern street railway tracks are based on doing work with no car interference. These costs will be somewhat increased under car operation, with machines outside the tracks, or decreased with machines of larger capacity.

The freight rates for hauling machines to and from work are in accordance with rates approved by the Public Service Commission of the State of New York, First District, and include the total cost of maintenance of the car equipment, cost of trackage and overhead line rights and office expenses of the freight department. These rates vary according to the length of haul, the figures given being for an average haul. This haulage cost would be considerably reduced where the track department does its own handling of material, etc., and where only the wages of crews are charged against it instead of having the freight department make a general charge per car-mile.

Cost with Batch Mixer

The batch mixer, for which the following costs for operation are given, is of 0.5 cu. yd. capacity. It can be bought, mounted on a car, for $1,300, and is electrically operated as to mixing only, so that it must be hauled to and from the work daily.

The number of men employed and their rates per hour in operating a machine of this character are: one assistant foreman, 25 cents; one operator, 25 cents; four laborers, 20 cents; six laborers, 18 cents; fourteen laborers, 16 cents; one checker of time and material, 15 cents—or a total cost of $47.50 for one day of ten hours. This cost is distributed to the various operations as shown in Table 1.

Table 1.—Cost per Day for Gang on One Batch Machine

Operation of the machine	$ 2.50
Watching mix and dumping	4.25
Handling material to the machine	13.50
Removing and placing the track	22.10
Ramming and tamping under the rail	3.85
Checking	1.50
	$47.70
Add other charges:	
Overtime for cleaning	$0.90
Interest on investment	.58
Freight to and from work	6.25
Lubricants, repairs and incidentals	2.33
	$10.06
Total	$57.76

A gang of this size will average in a ten-hour day approximately 675 ft. of single track with concrete 7 ins. deep. The area, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, is equal to 94.22 cu. yds., making the unit cost $0.613 per cubic yard, exclusive of material.

Cost with Continuous Mixer

A good continuous mixer of a standard make can be purchased for $560. Although such mixers are supplied on wheels for use at the side of the track, a good car with old pony wheels and a wooden frame can be made for approximately $30, thus bringing the total cost to less than $590. This cost is for a gasoline-operated machine, but an electrically operated one is preferable. Provided an old motor is obtainable, the first cost will vary but little from gasoline, whereas the cost of operation will be less.

As a machine of this kind is easily derailed, it need not be removed from the street daily, and can be left on the work continuously ready for use at any time, with no outlay for freight charges until it is required at other points.

The number of men employed, and their rate per hour, in operating one of these machines are: one assistant foreman, 25 cents; one operator, 25 cents; two laborers, 20 cents; three laborers, 18 cents; eight laborers, 16 cent; one checker of time and material, 15 cents—or a total cost of $28.70 for a ten-hour day. This cost is distributed to the various operations as shown in Table 2.

Table 2.—Cost per Day for Gang on Continuous Mixer

Operation of machine	$ 2.50
Handling material to machine	10.20
Distributing in track	12.10
Ramming and tamping under rail	2.40
Checking	1.50
	$28.70
Add other charges:	
Overtime for cleaning	$0.50
Interest on investment	.26
Freight to and from work	1.25
Gasoline, oil and repairs	2.25
	$4.26
Total	$32.96

This gang will average 430 ft. of single track per ten-hour day, with concrete 7 ins. deep. This area, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, is equivalent to 60.054 cu. yds., making the unit cost $0.5488 per cubic yard, exclusive of material.

Mixing by Hand

Of course, in mixing by hand the number of men employed may vary, but for an illustration we may assume that as many are employed as on the continuous mixer, exclusive of the operator. The cost then would be distributed to the various operations as follows:

Table 3.—Mixing by Hand

Distributing material and mixing	$10.50
Distributing in the track	11.80
Ramming and tamping under the rail	2.40
Checking	1.50
	$26.20

This number of men in a ten-hour day will average 225 ft. of single track with concrete 7 ins. deep, which, with 6 x 8-in. x 8-ft. ties spaced 2 ft. centre to centre, amounts to 32.77 cu. yds., equivalent to a unit cost of 80 cents per cubic yard.

The foregoing figures were obtained from many years' experience in this line and from carefully collected data, and appeared in Engineering Record. While they may not apply to all locations, the costs can be easily adjusted to meet any conditions from the information given.

A good trade magazine fills a highly important niche in journalism. Not only does it carry the news of the trade, but it bears serious relation to the industry itself. In many industries it wields a greater power than any single house in that industry. It operates not only as an effective means by which manufacturers can talk to the trade about their products, but it also acts as a stimulant to higher ideals of business, and keeps down the abuses simply by turning the light on them. There is no question at all about the importance of trade magazines when they are under able

Personal Mention

At Stratford, Ont., Mr. George Heideman, City Building Inspector, was made the recipient of a cabinet of silver from the staff of the City Hall on the occasion of his marriage.

Prof. A. M. Gray, assistant professor of electrical engineering at McGill University, has resigned on his appointment as head of the electrical engineering department of Cornell University.

Mr. A. M. West, City Engineer of North Vancouver, B.C., has been appointed a provisional lieutenant in the Canadian Engineers. The City Council have granted him six weeks' leave of absence in order that he may go to Esquimalt to pursue his military studies.

The resignations of Mr. Breckon, Water-works Engineer, Mr. D. B. McLay, Assistant Engineer on Construction, and Mr. R. M. Grancey, Bridge Engineer, have been accepted by the City Council of Vancouver, the resignations to take effect on July 31. It is understood that the city has not enough work to keep the whole of the engineering staff employed at present.

Mr. A. F. Barbour, civil engineer, of Boston, has been looking into the water situation at St. John, N.B. The Council are endeavouring to locate springs from which the town may secure pure water. Mr. Barbour will make a report to the Council suggesting the best course to be pursued.

The death is announced of Mr. William Goodfellow, an architect of New Westminster, B.C. He had been a resident of that district for a number of years, and his son, Captain William Goodfellow, now in England with the 29th Battalion, also practised as an architect in New Westminster for some time.

Quebec has lost a well-known architect in the person of Mr. Rene Lemay, who died at his summer residence at Cap Rouge recently. During his active career Mr. Lemay contributed extensively to Quebec's architecture, and many of the modern edifices which are monuments to the commercial expansion of the ancient capital were planned by him. Among the buildings which he designed are the Merger Building, the Dominion Fish and Fruit Building, Quebec Technical School, Caisse d'Economie, St. Roch's, the Lindsay Building, and the new St. Patrick's Church, besides other splendid buildings throughout the province, including Chicoutimi Cathedral. The late Mr. Lemay represented St. John's Ward in the City Council for six years, and he was a former President of the Dominion Association of Architecture.

Mainly Constructional

East and West From Coast to Coast

The Province of Quebec Association of Architects will hold an examination in Montreal from July 26 to 31, inclusive.

Work will be commenced early this month on the erection of the steel on the new viaduct at St. Catharines, Ont. About twenty carloads of steel and timbers to be used in the construction are on the site.

At West La Have, N.S., A. V. Conrad and J. Milledge have incorporated the La Have Concrete Company, Limited, with a capital stock of $50,000. The company will manufacture concrete materials, cement and lime.

Recent floods in Alberta, during which the Bow River reached a height of 37 feet above low level mark, caused a loss in property estimated at a million dollars. The height reached by the river is only slightly lower than the record established sixteen years ago.

The Riverside Water Supply Company, Limited, has been incorporated at Revelstoke, B.C., with a capital stock of $5,000. The company will carry on a general water-works business, with the right to construct water-works systems and to charge tolls for the supply of water.

With a capital stock of $500,000, Universal Stove and Furnace Company, Limited, has been incorporated at Toronto by G. M. Kelley, J. D. Falconbridge, I. A. Cooper, L. C. Stephens, and G. Burley, all of Toronto. The firm will manufacture all kinds of furnaces, including heating and ventilating plants, crematories, incinerators, and blast furnaces.

The Foundation Company, Limited, Montreal, have commenced the construction of the substructure of a bridge over Shaw Creek, near Darling, Ont., for the C. P. R. The work consists of four piers and two abutments, with the necessary retaining and wing walls. Two of the piers will be built by pneumatic caissons, and the other two by the open dredging method.

In connection with the harbour improvement scheme at Toronto, the space between the piles sunk last year opposite the Lake Shore Road and the shore is being filled in. The distance between the piles and the shore varies between 700 and 1,300 yards. A large suction dredge is at work on the fill, delivering sand, etc., from the bottom of the lake outside the piles, through a pipe line to the fill.

The contract for the second addition to No. 1 elevator of the Montreal Harbour Commissioners has been let to the Geo. A. Fuller Company, Limited, Montreal. The piling contract is now being carried out by the Peter Lyall and Sons Construction Company, Limited, Montreal. The plans were drawn up by the John S. Metcalf Company, Limited, Montreal. This is one of the largest contracts given out this season in the city.

With the exception of strips aggregating about seventy-five miles, ballasting on the British Columbia sections of the Canadian Northern Pacific Railway has been completed. Work is proceeding on the unfinished sections, and arrangements are being made to start the construction of station buildings at an early date. Sir William Mackenzie is reported as saying that the line will be ready for operation by September.

The City Council of Toronto have decided to expropriate Grosvenor Street Presbyterian Church in order to make room for the extension of Terauley Street. Notice of expropriation was served last summer, but it is not known yet when the old buildings will be demolished. There was some doubt as to whether the city wanted the whole of the church property or only a part of it, but it has been finally decided to take over the whole property.

The contract for the erection of the substructure of the Moncton bridge over the Petitcodiac River, N.B., has been let to Engineers and Contractors, Limited, Granville Ferry, N.S. A few weeks ago the Provincial Government let this contract to another firm but later withdrew the work, and invited fresh tenders. As a result of this the contract has been given out as above. Owing to the enormous rise and fall of the tide in the river the work will involve some difficult problems.

The opening is announced of the new Customs House at Calgary, Alta. At present the various divisions of the Customs Department are located under five different roofs, but the new building, which has been under construction for two years, will house the whole of the Department comfortably. The architect for the building was Mr. Dowler. It is constructed of Calgary brick and Calgary stone, and covers an area 100 x 120 ft. It includes examining warehouses and administration offices. The cost of construction was $500,000.

The walls of the new Government dock, Vancouver, are nearing completion. Twenty-one cribs for the foundation have been sunk already, and it is expected that the remainder of the cribs will have been sunk by the middle of this month. The foundations and the 800-ft. wall on the west side of the dock are completed. The contractors for the dock, Messrs. Henry, McFee & McDonald, have just accepted a contract from the Great Northern Railway of half a million dollars for double tracking and snow sheds in the Cascade Mountains.

The difficulty over the supply of asphalt for the city of Montreal has been overcome by the discharge, by Chief Justice Archibald, of the injunction granted to Mr. C. P. Dubuc, representing Mr. J. Baker, Jun., of New York, restraining the city from entering into a contract with the Aztec Oil and Asphalt Refining Company. The removal of the injunction was unopposed. The Aztec Company were willing that the Board of Control should cancel the provisional contract agreed upon, and this opened the way for the Controllers to call for fresh tenders. The injunction was originally granted on the ground that the Controllers had exceeded their authority.

The City Council of New Westminster, B.C., have endorsed an agreement with the Vancouver, Victoria and Eastern Railway under which the railway company will build and operate industrial tracks, serving the leaseholders on the improved water front area. It is provided that the city may at any time take over the tracks on payment to the company of the cost of construction, should the city desire to operate them. Application will be made to the Railway Board for permission to proceed with the work, and as there is no opposition on the part of the other railways such permission will probably be granted by wire, enabling construction to be started immediately.

At the meeting of the representatives of the municipalities interested in the construction of the Toronto-Oshawa road held at the City Hall, Toronto (as noted in our last issue) Mr. W. A. McLean gave the costs of nine different pavements. The cost of a concrete road was placed at $625,000, and a macadam and gravel roadway at $239,000. Some of the representatives stated that their municipalities could not afford to pay for a concrete pavement. Mr. McLean strongly recommended the construction of a macadam and gravel roadway. He said that it would give good service for the probable traffic of the next ten years. A committee was appointed to consider further Mr. McLean's report and to report on the type of road they would recommend to be built, and also to consider the question of the taxation of abutting lands and provision for the maintenance of the road. It is expected that the scheme will be worked out amicably.

Over a million dollars has been spent by the Ford Motor Company of Canada on buildings in Canada during the last year. These include new branch buildings and assembly plants at Montreal, Toronto, and London, and an addition to their factory at Ford, Ont. The Montreal building, which cost a quarter of a million dollars, opened its doors on January 23rd, when it housed the annual Montreal Motor Show. The Toronto branch building cost over $325,000, and was opened late in February. The London building was ready for use about the middle of March, and cost $140,000. The factory addition at Ford, Ont., involving an expenditure of $300,000, is now practically completed. The building of the present addition added 130,000 square feet of floor space, bringing the total floor area up to more than nine acres. Plans are now under way for buildings of equal magnitude in Winnipeg and other branch cities, and it is stated that work will be started on these in the near future.

According to Mr. W. W. Butler, Vice-President of the Canadian Steel Foundries, Limited, and the Canadian Car and Foundry Company, he has been successful in closing a contract in Petrograd for five million artillery shells. This is said to be one of the largest contracts ever given by Russia for foreign-made ammunition. The shells will be manufactured in Canada, and will be delivered to the order of the Russian Government at Canadian ports. There has been some delay in securing the machinery to make the shells for this order, but it is anticipated that the necessary lathes, etc., will be installed by the middle of July, when day and night crews will be put to work. The company will do both the forging and the machining.

Portable Asphalt Mixing Plant

A new portable asphalt mixing plant having a number of distinctive features has just been put on the market. For a plant of its size and cost it is unusual in having a minimum capacity of 800 square yards of two-inch sheet asphalt topping per day of ten hours. The capacity for asphaltic concrete, Topeka mix, or asphalt macadam is much larger.

The mixing platform of the plant is so elevated that a wagon can be driven under it to receive the load from the mixer without elevating the plant on its wheels or excavating for this purpose. The platform is arranged for one-man operation, the levers for controlling clutches and plant being within easy reach. The mixer is a two-shaft, pugmill type, with removable side and end liners; it is provided with two full sets of blades, the binder being solid manganese. The sand-measuring box and asphalt bucket are supported on scales. A drying drum of special construction has been designed for this plant to obviate the difficulties so often encountered in heating a sufficient amount of sand and stone. Features that count in the economical upkeep of such plants as this are the removable steel wearing plates in the material chutes and chilled rims for all chain sprockets.

Plant in operation.

As illustrated, the plant would be operated as two units, the second unit being the asphalt kettle. The mixing plant is also supplied without boiler and engine. In other words, the contractor or municipality already provided with a portable boiler, engine and kettles can secure the mixing plant without making an additional investment for these units.

The plant is designed especially to meet the requirements of contractors and municipalities having new construction and maintenance work to perform in scattered territory, or in an amount insufficient to make a stationary plant economical. It is the product of the Iroquois Works of the Barber Asphalt Paving Company, Buffalo, N. Y.

A New Type of Drag-Line Bucket

After a five-year try-out on the Calumet-Sag and North Shore channels, which are additions to the large system of the Chicago drainage canals, a new form of drag-line bucket, as illustrated herewith, is being introduced to the trade. It is a back-dumping bucket, and consists of a shell, pulling bail, and a combination hoisting bail and back gate. In its digging position the pulling bail is connected to the shell at points above its centre of gravity. The pulling bail is also connected by means of links to the hoisting bail and back-gate in such a manner that tension on the drag-line closes the gate and keeps it closed. When the bucket is suspended on the hoisting bail and the tension on the drag-line is released the back of the shell tips down away from the back-gate, allowing the load to slide and drop out. Bronze sliding blocks carried in slots in the shell connect it with the pulling bail, and these slots give the required motion to the link connections to permit the bucket to dump when the tension on the drag-line is released. Special attention is given to the flexibility of the bucket, and binding in any of the parts is prevented by the provision of loose-fitting connections. All standard buckets are equipped with teeth bolted to the digging edge at an angle to give the proper "suck." Rock teeth set at the proper angle are furnished with the bucket for heavy digging in rock. The teeth are tipped with manganese steel points, which can be replaced when worn.

The construction of the bucket is simple, and repairs can be made in the field with the average contractor's tool or shop equipment. All bushings are made from bronze and steel tubing.

The bucket is operated with two single-part lines—a drag-line and a hoist-line. By the manipulation of these two lines the bucket is placed in different positions. The bucket may be made to dig at any slope desired by varying the tension on the hoist-line while paying it out. When the bucket is filled it is raised to the dumping position at the end of the boom by pulling in on the hoist-line while keeping the drag-line taut. When the tension on the drag-line is released the bucket is dumped. The shell automatically resumes its closed position after dumping.

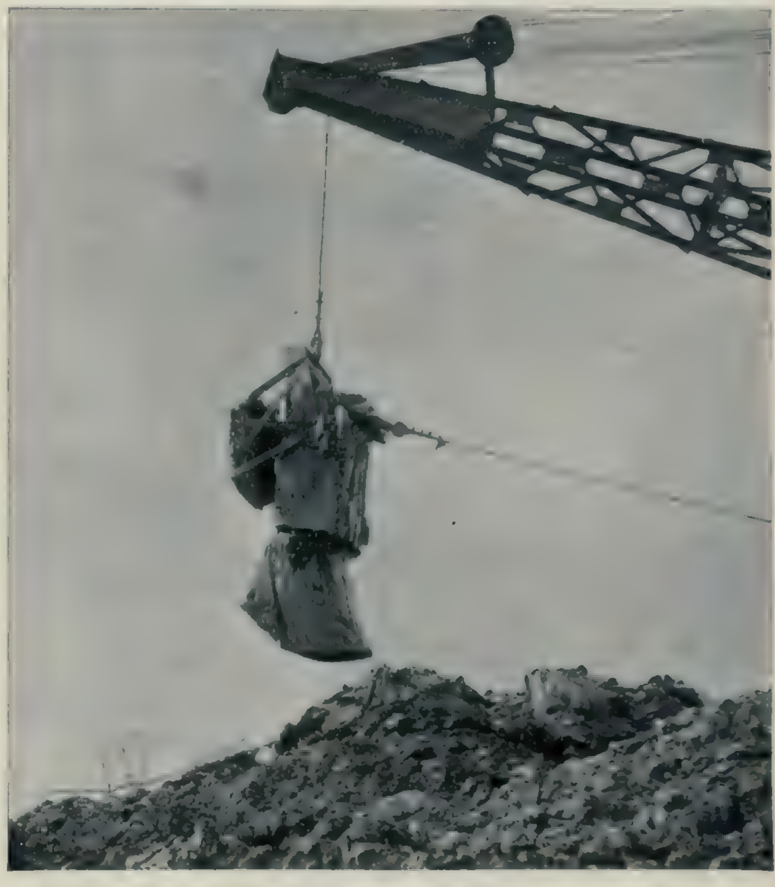
As the bucket is back dumping the load is always thrown away from the machine, and the centrifugal force imparted by the swinging of the boom assists the dumping of the load beyond the radius of the machine. Both bails are very short, and permit the bucket to dig right up to the machine.

The bucket was designed by Mr. Shnable, of the contracting firm of Shnable & Quinn, for use on their work on Section 10 of the Calumet-Sag Canal. The patents on this drag-line bucket have been purchased by the Brown Hoisting Machinery Company, of Cleveland, Ohio, who are now manufacturing the bucket as a Brownhoist product.

Mr. J. E. Carreau, dealer in and manufacturer of church ornaments, decorations and furniture, has taken offices, show rooms, and manufacturing premises at 13 Notre Dame Street East, Montreal. He has had many years' experience in this line of business, and is well known in Catholic ecclesiastical circles. Mr. Carreau supplied the dado, communion rail, and table for St. Charles Parish Church, Centre Street, Montreal; he furnished three altars and baldequin, the Bishop's throne and pulpit, etc., for the chapel of the Clercs of St. Viateur at Joliette, Que.; two altars, communion furniture, complete set of stations of the cross (in artificial marble), for the Church of St. Francis d'Assisis at Longue Pointe, and many other similar contracts. This firm make a specialty of artificial marble, statuary, pictures, and religious ornaments such as are to be found in all Catholic churches. They are the only manufacturers of some of these lines in Canada, and are among the leading dealers in church furnishings.

The Cranford Construction Company, of Cincinnati, Ohio, have secured the contracts for Simplex concrete piling for a passenger station and a bridge foundation to be erected at Johnstown, Pa., for the Pennsylvania Railroad.

A description of a 900-gallon auto flusher for street cleaning work forms the central feature of a catalogue issued recently by the Tiffin Wagon Company, of Tiffin, Ohio, who also make a line of horse-drawn motor power flushers and motor-driven and horse-drawn sprinklers, besides dump wagons and sanitary garbage carts. As described in the catalogue, the flusher is mounted on a motor truck chassis (built by the same company), and an extra four-cylinder gasoline engine on the rear end of the chassis drives a two-stage centrifugal pump with a capacity up to sixty pounds pressure. The tank may be filled from hydrant or standpipe, or from streams or cisterns if desired, in which case a special attachment is provided. The flusher nozzles are provided with universal joints, enabling two streams of water to be directed at any angle.



Dumping drag-line bucket.

The Canadian Pacific Railway Construction Corps, under Lieut-Col. C. W. Ramsay, of the C. P. R., have arrived in England. The corps, which trained in St. John, N.B., took with them a large supply of equipment for building railways and bridges.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Amherstburg, Ont.
The Town Council have been petitioned to lay a pavement on Sandwich and Aspley Streets. Approximate length, one mile. Clerk, G. E. Pulford.

Bathurst, N.B.
The City Clerk, John G. Staut, will receive tenders until 8 p.m., July 10th, for the construction of a dam, power house, boiler house, piping, pumping station, mains, sewer pipe; manholes, and a standpipe, with a capacity of 405,000 gallons. Plans and specifications with the Clerk.

Beamsville, Ont.
The Town Council have had plans drawn for concrete sidewalks to be laid on a number of streets by day labor. Clerk, W. D. Fairbrother.

The Town Council contemplate laying about ¾ mile of pavement. Clerk, W. D. Fairbrother.

Didsbury, Alta.
The Town Council are considering the construction of a quantity of cement sidewalks. Clerk, A. Brusso.

Fort Erie, Ont.
A by-law has been carried providing for the construction of a concrete road from the North Line to Buffalo Ferry, and of a number of village streets. Town Clerk, W. Simmonds.

Grimsby, Ont.
Plans are being prepared for paving to be laid on all streets excepting Main Street, which will be paved by the County. Town Clerk, C. H. Bromley.

Guelph, Ont.
The City Engineer is preparing plans for the construction of concrete sidewalks on Harris Street, and of a 30-inch concrete pipe on Dundas Road. Clerk, T. J. Moore.

Harwich Township, Ont.
The Township Council have decided to lay a number of tile drains. Work to commence very shortly. Clerk, G. W. Riseborough, Blenheim, Ont.

Moulton Township, Ont.
The Township Council will receive tenders until noon, July 14th, for the construction of a drain. Work to include about 27,000 cubic yards of excavation. Plans and specifications with the Township Clerk, G. A. Duff, R. R. No. 1, Low Banks, Ont., and with A. M. Jackson, Engineer, Temple Building, Brantford.

Ottawa, Ont.
Tenders on trenching, cartage, and laying of water pipe will be received until August 3rd by the Chairman of the Waterworks Commission. Plans and specifications at offices of the Waterworks Engineer, R. L. Haycock, and of the Consulting Engineer, S. B. MacRae, Sparks Street.

The Chairman of the Waterworks Commission will also receive tenders until August 3rd on the supply of high lift pumps and motors for Lemieux Island. Plans and specifications with the above Engineers.

Pelham Township, Ont.
Tenders on drainage work will be received until July 16th by the Township Clerk, A. N. Armbrust, Ridgeville. Plans and specifications with the Clerk.

Sackville, N.B.
The Town Council are considering two suggestions for an addition to the waterworks, viz.:—the erection of a large tank or the purchase of an automatic pump at a cost of about $3,000. Clerk, Thomas Murray.

Sudbury, Ont.
The Town Council contemplate laying a quantity of pavement. Clerk, W. J. Ross.

Thurlow Township, Ont.
Tenders on the construction of concrete walks will be received until July 20th by the Trustees of School District No. 1. Secretary, W. C. McDonald, R. F. D. 109, Belleville.

Toronto, Ont.
W. A. McLean, Provincial Highways Engineer, Parliament Buildings, has reported that the cost of the Toronto-Oshawa highway will be about $625,000 for concrete construction, and $239,000 for macadam and gravel. He has recommended the latter method.

CONTRACTS AWARDED

Calgary, Alta.
The contract for paving at Hudson's Bay Reserve has been let by the City Council and the Hudson's Bay Company to the Crown Paving Company, Rideau Park, at $125,000.

Eastview, Ont.
The contract for laying concrete and sandstone block sidewalks on Montreal Road has been let by the Town Council to D. Desjardins, Eastview. Approximate cost, $9,000.

Grey Township, Ont.
The Township Council have awarded the contract for the construction of the Beauchamp drain to August Guhr, Seaforth, Ont. Approximate cost, $23,000. Work has been commenced.

Saanich, B.C.
A contract for grading on North Quadra Street has been let by the Town Council to Jones & Rant, Limited, Saanich, at $8,688.

St. Vital, Man.
Contracts for laying concrete pavement have been let by the Municipality to Guilbault Company, Limited, St. Boniface, for St. Anne's Road, and part of St. Mary's Road, and to T. Jackson & Sons, 370 Colony Street, Winnipeg, for the remainder of St. Mary's Road.

Sydney, N.S.
The City Council have let the contract for the erection of the pump house at Middle Lake to Chappell Bros. Company, Limited, 62-80 Brooklands Street, at $13,000, and for the supply of pumps to the Turbine Equipment Company, Limited, C. P. R. Building, Toronto.

Whitby, Ont.
The Town Council have let a contract for the construction of approximately 50,000 square feet of cement sidewalks and crossings to J. T. Hornsby, Athol Street, at 9.4c. per foot.

Wingham, Ont.
The Town Council have let a contract for the construction of sewers on St. Patrick Street to T. J. McLean & Company, Wingham, and on John and Minnie Streets to Greenaway & Guest, Wingham.

Railroads, Bridges and Wharves

Arden, Man.
The Municipality of Lansdowne are considering the erection of a reinforced concrete bridge over White Mud River. One span, 90 feet long, roadway 18 feet wide. Secretary, M. E. Broughton, Arden.

Broadview, Sask.
The Canadian Pacific Railway are receiving tenders on waterproofing work in connection with the construction of a concrete subway. Plans and specifications with the Divisional Engineer, J. S. Holden, Winnipeg.

Dover Township, Ont.
Tenders on the construction of two steel and concrete bridges will be received until July 10th by P. Antaya, Paincourt. Plans and specifications with the Township Clerk, J. Welsh, Chatham, and the Engineer, W. G. McGeorge, 153 Queen Street, Chatham.

Grey County, Ont.
Tenders on the construction of three concrete arch bridges will be received until 6 p.m., July 10th, by the County Clerk, F. H. Rutherford, Owen Sound. Plans and specifications with the Warden, County of Bruce, Burgoyne, with J. W. Sinclair, Tara, with the Clerk, and at office of R. McDowall, Engineer, 635 Second Avenue W., Owen Sound.

Melanchton Township, Ont.
The Township Engineer, I. Traynor, Dundalk, is preparing plans for four reinforced concrete bridges for the Township Council.

Renfrew County, Ont.
The Township Engineer, J. L. Morris, Pembroke, has prepared plans for a bridge between Stafford Township and

Pembroke. Clerk, R. J. Rooney, Pembroke.

CONTRACTS AWARDED

Brant County, Ont.
Work is to start at once on the erection of two steel and concrete bridges for the County Council. The contract for steel has been let to Hamilton Bridge Works Company, Limited, Hamilton, at $1,834, and for concrete work to G. Thompson, 223 West Mill Street, Brantford, at $2,900.

Edmonton, Alta.
The Edmonton, Dunvegan & B. C. Railway have let the contract for the construction of about 60 miles of railroad between Spirit Lake and Grande Prairie to G. H. Webster, 1316 Prospect Avenue, Calgary.

Farnham, Que.
The Municipality have let the contract for the concrete work and construction of approaches for several bridges to Andre Choiniere, Farnham.

La Baie St. Paul, Que.
The general contract for an addition to the dam for L'Hospice de la Baie St. Paul has been awarded to Baie St. Paul Electric Company, at $3,500.

Lanark County, Ont.
The County Council have awarded a contract for the erection of a bridge over the Clyde River to the Ontario Bridge Company, Crown Building, Toronto, at $8,950. Steel girder construction, cement piers, abutments, and floor.

Lindsay, Ont.
The contract for the construction of a bridge over the Scugog River for the Department of Public Works, Ottawa, has been let to Hamilton Bridge Works Company, Limited, Bay Street N., Hamilton.

Simcoe County, Ont.
The County Engineer, F. Barber, 57 Adelaide Street E., Toronto, is in the market for supplies for the construction of bridge abutments.

Public Buildings, Churches and Schools

Bryant, Sask.
Tenders on the erection of a school for the Trustees of School District No. 3505 will be received until July 9th by the Secretary, Andre Walton. Plans and specifications from the Secretary, Mercury Office, Estevan, and from Waterman & Waterbury, 115-118 Donahue Building, Regina.

Charlottetown, P.E.I.
Tenders on repairs to Grace Methodist Church and parsonage will be received until July 15th by R. E. Mutch, c/o R. E. Mutch & Company, 77 Grafton Street. Specifications with Mr. Mutch.

Dartmouth, N.S.
Tenders will be received until 4 p.m., July 12th, by R. C. Desrochers, Department of Public Works, Ottawa, for interior fittings for the Post Office. Plans and specifications with E. H. Whalpley, Clerk of Works, Dartmouth, W. Bishop, Inspector, Dominion Buildings, Halifax, and at the Department, Ottawa.

Fairbank, Ont.
Tenders will be received until July 10th by W. Deacoff, Dufferin Street, for repairs and painting at North School, and for concrete work at Vaughan Road School. Plans and specifications with the Architects, Edwards & Saunders, 18 Toronto Street, Toronto, and with Mr. Deacoff.

Hawkshaw, N.B.
A church is being built by day labor for the Baptist Congregation. Estimated cost, $3,000. Seating will be required. Chairman of the Building Committee, G. F. Burden, Poquiock, N.B.

Kingsville, Ont.
W. Valentine, Secretary to the Board of Education, will receive tenders for the installation of closets and septic tanks. Plans and specifications to be furnished by tenderers.

Lake Johnson, Sask.
The Trustees of School District No. 2465 have been empowered to borrow $3,500 for the erection and equipment of a school. Treasurer, A. Rutledge.

Peterborough, Ont.
Plans are being prepared for repairs to the County Court House. Clerk, E. M. Elliott.

Port Colborne, Ont.
Plans and specifications for a Public School, estimated to cost $35,000, have been submitted to the Board of Education by the Architect, C. M. Borter, 102 Main Street, Niagara Falls South.

Sayabec, Que.
The School Commissioners are building a school by day labor, at an estimated cost of $20,000. Secretary, T. Levesque.

Toronto, Ont.
The Board of Education will receive tenders until July 13th for the enlargement of Mc Murrich School and for midsummer repairs at various schools. Plans, etc., at office of the Building Superintendent, City Hall.

Wadena, Sask.
The Trustees of School District No. 1435 have been authorized to borrow $3,000 for construction of foundations and repairs to school, and for various other improvements. Treasurer, L. C. Wirtz, Dana.

Wickam West, Que.
The erection of a school, estimated to cost $5,000, is being considered by the School Commissioners. Secretary, A. J. Vanasee.

CONTRACTS AWARDED

Hamilton, Ont.
The contract for wiring at the Barton Street Hospital has been let by the City Council to Culley & Breay, 35 King Street W.

Newcastle, N.B.
The contract for the installation of an elevator in the Miramichi Hospital has been let to the Otis-Fensom Elevator Company, 146 Hollis Street, Halifax.

Newport, Que.
J. H. Martin & Fils, Trois Pistoes, are erecting a church for the Roman Catholic Congregation, estimated to cost about $78,000. Stone and brick construction, zinc roofing.

Regina, Sask.
Work has been started on the erection of a hospital and nurses' home by the general contractors, L. Poole & Emery, Smith Street and Twelfth Avenue. The contract for millwork has been let to Gushing Bros., Dewdney Street, and for heating and plumbing to the Capital Plumbing & Heating Company, 1306 Eleventh Avenue. Approximate cost, $20,000.

St. Louis de Courville, Que.
In connection with the church in course of erection, the contract for heating, plumbing, and electrical work has been let to Jobin & Paquet, Abraham Hill, Quebec, and for painting to the general contractors, Elz, Metivier & Son, St. Damien.

Toronto, Ont.
The Johnson Heat Regulator Company, 118 Adelaide Street W., have been awarded contracts for heat regulators at Rosedale and Jesse Ketchum Schools.

The Board of Education have awarded the following contracts for plumbing:—Brown Street School, Balmy Beach, A. E. Melhuish, 1174 College Street, $1,519; Pape Avenue, Purdy Mansell Company, 61 Albert Street, $796; Earl Grey, J. R. Seager, 799 College Street, $1,065; Humberside, Earlscourt, R. Paterson, 907 Keele Street, $1,697.

Business Buildings and Industrial Plants

Camrose, Alta.
Tenders on the erection of a telephone exchange building will be received until noon July 9th, by The Deputy Minister of Public Works, Edmonton. Plans and specifications at offices of the Provincial Architect, Edmonton, and of the Depart of Public Works, Calgary.

Gananoque, Ont.
The Steel Company of Canada are considering the erection of an addition to their factory on Mill Street. Stone construction, composition paper roofing. Approximate cost, $3,000. Manager, F. B. Cowan.

Glencoe, Ont.
John McVicar, Ferguson's Crossing, Glencoe P.O., is building farm buildings estimated to cost $3,500. Frame construction.

Katesville, Ont
Farm buildings are being erected by J. Godard, Ailsa Craig P. O. Approximate cost $3,000.

Montreal, Ont.
A. Racine, Limited, 1967 St. Urbain Street, have commenced the erection of a carriage factory, estimated to cost about $3,000. Brick construction.

Moose Jaw, Sask.
Tenders on alterations to business premises for E. Matthews, Maple Leaf Hotel, are being received by Reilly, Dawson & Hancock, Room 20, Russell Block. Brick and frame construction. Estimated cost, $6,000.

Oshawa, Ont.
The erection of a shell factory on Emma Street is contemplated, and a by-law providing for the loan of $8,000 for this purpose will be voted on shortly. E. L. Crabtree, c/o the Dominion Machinery Company, 82 Adelaide Street E., Toronto, is an interested party.

Paris, Ont.

Plans of stock sheds have been prepared for W. G. Bailey by L. A. Wardell, 110 Hunter Street W., Hamilton. Frame construction, concrete foundation.

Red Deer, Alta.

Tenders on the construction of a warehouse on Gaetz Avenue N. for Nash Bros., Minneapolis, Minn., will be received until July 12th by Seymour & Dawe, Architects, 5 Gaetz Avenue N. Brick construction, concrete flooring, patent roofing.

St. John, N.B.

Work has been started by day labor on the construction of a warehouse for C. H. Peters & Sons, Limited, Ward Street. Approximate cost, $10,000.

Sydney, N.S.

The building now in course of erection for the B. Atkinson Estate will be finished as stores and apartments, the arrangements with regard to a theatre having been abandoned.

Tavistock, Ont.

Krug Bros. are building a store on Woodstock Street. Brick construction.

Toronto, Ont.

W. Watson, No. 2, The Maples, Bain Avenue, has commenced work on alterations and additions to stores and residences at 612 Logan Avenue. Brick construction, felt and gravel roofing. Approximate cost, $3,000.

Work has been resumed on the erection of stores and apartments at 1830 Queen Street E., by Grimshaw Bros., 34 Brookmount Road. Brick construction, tar and gravel roofing. Approximate cost, $15,000.

Welland, Ont.

The erection of two stores and a flat on Main Street is contemplated by H. Kaplin. Estimated cost, $10,000.

Windsor, Ont.

J. C. Pennington, Labelle Building, is preparing plans for alterations to business premises on Dougal Street for J. F. Smythe, 150 Ouellette Avenue. Estimated cost, $3,500.

Yarmouth, N.S.

Tenders on the erection of a station for the Halifax & South Western Railway will be received until noon, July 17th, by the General Superintendent, J. Bain, Bridgewater, N.S. Plans and specifications with the General Freight & Passenger Agent, Halifax, with the Agent, Yarmouth, and with the General Superintendent.

CONTRACTS AWARDED

Auburn, Ont.

David Lochart has let the general contract for remodelling farm buildings to James McGill. Approximate cost, $3,000.

Hagersville, Ont.

A branch is being erected at Howard and King Streets for the Union Bank of Canada, Winnipeg, Man. The contract for carpentry has been let to R. A. Nicholson, 4 Hamilton Avenue, Mount Hamilton, the roofing contract to H. W. Johns-Manville Company, 19 Front Street E., Toronto, the painting contract to E. Foley, 35 Oak Avenue, Hamilton, the contract for plumbing to Staunton & Mitchell, 173 York Street, Hamilton, and for electrical work to Culley & Breay, 35 King Street W., Hamilton.

Montreal, Que.

The contract for the erection of a garage at Ann and Ottawa Streets for the Montreal Light, Heat & Power Company has been let to T. L. McBean, 29a Belmont Street. Steel construction.

Moose Jaw, Sask.

The F. W. Woolworth Company have let the contract for alterations to their store to Poole & Emery, 20 Russell Block. Approximate cost, $10,000. Canadian Manager, R. Connable, Queen and Yonge Streets, Toronto.

Ottawa, Ont.

The contract for the erection of a garage on Frank Street for J. B. and W. H. Fraser, 50 Robert Street, has been let to S. F. Smith, 448 McLeod Street. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $5,000.

St. John, N.B.

In connection with the stores being built for Scovil Bros., Limited, King Street, the contract for tile work has been awarded to Nonneman Tiling Company, 254 Union Street.

Work has been commenced on remodelling the Bank of British North America at Union and Sydney Streets by Edward Bates & Son, 73 Duke Street. Approximate cost, $9,000.

In connection with the stores to be erected at 55-57 King Street for Scovil Bros., Limited, the contract for prism glass has been let to Luxfer Prism Company, Limited, 100 King Street W., Toronto, and the plastering contract to the general contractors, B. Mooney & Sons, 112 Queen Street. Contract for electrical work and fittings not let.

Toronto, Ont.

Alterations are being made to offices at Yonge and Victoria Streets for the Confederation Life Association, Yonge and Richmond Stretes. The contract for masonry has been let to Brown & Love, 46 Price Street. Approximate cost, $10,000.

Windsor, Ont.

The general contract for alterations to a billiard parlor for W. McGregor has been let to R. Westcott, 55 Oak Street. Approximate cost, $5,000. Architect, J. C. Pennington, Labelle Building.

Residences

Alderville, Ont.

Tenders on the erection of a teacher's residence on the Indian Reserve will be received until noon, July 22nd, by Duncan C. Scott, Department of Indian Affairs, Ottawa. Plans and specifications at the Post Offices, Cobourg and Alderville, at the office of W. R. Coyle, Indian Agent, Roseneath, and at the Department.

Beamsville, Ont.

Robert Culp is building a frame and reinforced concrete residence. Estimated cost, $3,500.

Crowland Township, Ont.

Fred Hogue, Myrtle Avenue, Welland, is considering the rebuilding of his residence.

The erection of a residence and barn to replace those destroyed by fire is being considered by Charles E. Furry, R. R. No. 1, Welland.

Curt Hill, Sask.

Tenders on the erection of a parsonage for the German Lutheran Congregation will be received until July 9th. Plans and specifications with E. J. Luedtke, Willmar Street. Frame construction.

Forest, Ont.

A residence is being built by J. Perre, Ann Street, at an estimated cost of $3,200. Frame and white brick construction.

Grimsby Twonship, Ont.

A residence is being built at Grimsby and Queenston Roads for John Rudolph, Grimsby Beach. Pressed brick construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

R. C. Van Dyke is erecting a residence, estimated to cost $3,500.

Hull, Que.

A permit for the erection of a residence has been issued to Edward Pelletier, Montcalm Street. Brick construction, stone foundation. Approximate cost, $6,000.

Lac Aux Saumons, Que.

Plans of a residence to be erected for the parish have been prepared by Ouellet & Levesque, 115 St. John Street, Quebec. Frame and brick construction, concrete foundation, metal roofing. Approximate cost, $4,000.

Lakeside, Que.

A contract is open for the removal of a house belonging to the Marcil Trust Company, 180 St. James Street, Montreal. Particulars from J. O. Harris, Architect, 180 St. James Street, Montreal.

Ottawa, Ont.

The erection of a residence on Bellwood Street is being considered by the Oakland Land Company, c/o C. C. Ray, 58 Sparks Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

B. A. Grison, 89 Fentiman Avenue, is receiving prices on plastering, painting, heating, plumbing, and electrical work required in the erection of two residences.

C. Goannis, 359 Le Breton Street, is considering the erection of a residence at an estimated cost of $4,000. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,000.

Poplar Point, Man.

Tenders on the erection of a parsonage will be received at St. Anne's Parsonage until July 10th. Plans and specifications with the Pastor, Rev. J. H. Hill.

Quebec, Que.

The masonry and carpentry work in connection with the residence being built on Aberdeen Street by E. C. Brochu, 147 St. Cyrille Street, will be done by day labor.

Rauol Gosselin, 171 First Street, is erecting a residence, estimated to cost $6,000. Brick and frame construction, concrete foundation, metal and asbestos roofing.

Alphonse Plante, 15 Kirouac Street, has commenced the erection of a residence on Victoria Street, estimated to cost, $3,000. Frame and brick construction, concrete foundation, metal and asbestos roofing.

Toronto, Ont.

R. C. Vaughan, 22 Summerhill Gardens, is erecting a residence, estimated to cost $4,500. Brick construction.

Tenders on the purchase and removal of three residences are being received by W. H. Hinton, 1 Harshaw Avenue, Secretary to School Section No. 32, York.

Verdun, Que.

Work on the erection of a residence has been started by E. Lamarre, 56 Gertrude Street. Brick construction. Approximate cost, $3,000.

Westmount, Que.

Work has been commenced on the erection of an addition to the residence of F. C. Wilson, 46 Belvedere Street, by day labor. Estimated cost, $12,000.

Windsor, Ont.

J. C. Pennington, Architect, Labelle Building, is preparing plans for a flat to be erected at Pine and Pelissier Streets. Estimated cost, $6,500. Owner's name withheld.

Wolfville, N.S.

F. W. Woodworth is about to start work on the erection of a frame residence, estimated to cost $3,000.

CONTRACTS AWARDED

Beauport, Que.

Work has been commenced on the erection of a residence for Alfred Marcil. The general, masonry, and carpentry contracts have been let to V. Talbot, 92 Morin Street, Quebec. Estimated cost, $5,000.

Bridgeburg, Ont.

B. J. McCormick has let the general contract for the erection of a residence to Charles Davis. General contractor will also do roofing and carpentry. Approximate cost, $3,300.

The contract for the erection of a residence for C. E. Hansel, 204 Ontario Street, St. Catharines, has been let to A. Teal, Bridgeburg. Brick veneer construction. Approximate cost, $3,000.

Charlottetown, P.E.I.

The heating contract in connection with alterations to the Manse of St. James' Church has been awarded to James McEachern, 34 Upper Queen Street, and the plumbing contract to Bruce Stewart & Company, 18-20 Queen Street.

Grimsby Township, Ont.

The plastering contract in connection with the residence being erected for T. B. Jarvis has been let to Read & Brider, Beamsville.

Hamilton, Ont.

Mrs. E. Foster, 391 Dundurn Street, has let the following contracts for the erection of a residence at 398 Dundurn Street:—masonry, G. E. Gaylard, 54 Lamorieux Street; carpentry and roofing, J. T. Tullock, 24 Sunset Avenue; plastering, C. J. Hartnup, 69 Aikman Avenue; heating and plumbing, Goodram Bros., 248 King Street W. Painting and electrical work not let.

J. H. Somerville, 28 Prospect Street, is about to build a residence on Leurster Avenue and has let the masonry to R. E. Jones, Maple Avenue, the plastering contract to F. Mountain, 2 Kenilworth Avenue, the contract for heating and plumbing to B. Barnes, and for electrical work to F. Thornton, 174 Balmoral Avenue. Painting not let. Estimated cost, $3,500.

Hensall, Ont.

The general contract for alterations to the residence of Dr. Bean has been let to Thomas Walsh, and the carpentry contract to Roland Cudmore.

Hull, Que.

The general contract for the construction of a brick and stone residence for C. Lebrun, Cloutier Hotel, Albert Street, has been awarded to Frank Albert, Chelsea Road, Wrightville. Estimated cost, $3,000.

Kentville, N.S.

The contract for the construction of a frame residence for John Cross has been let to C. Wright, Wolfville. Estimated cost, $3,500.

London, Ont.

Work has been started on the erection of a residence for Mrs. T. Dennis, 577 Princess Avenue, by Hyatt Bros., 288 Egerton Street. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

F. Corby, 44 Jacqueline Street, is about to erect a residence for T. Brazier, 358 South Street, at an estimated cost of $3,000. Frame and white brick construction.

Work has been started on the erection of a residence for A. J. Haines, West Avenue, by James Chivas, 80 Tecumseh Avenue. White brick veneer construction. Approximate cost, $3,000.

Montreal, Que.

The general contract for the erection of a residence for Mrs. J. McCormick, 665 LaSalle Road, Verdun Ward, has been awarded to J. Flynn, 473 St. Urbain Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Ottawa, Ont.

The heating contact in connection with the residenre being erected on Spadina Avenue by J. Villeneuve, 164 Bayswater Avenue, has been let to J. H. Cameron, 2488 Lewis Street, the plumbing contract to F. Tapp, 36 Armstrong Street, and the electrical work to C. C. Gould, 219 Florence Street.

Peterborough, Ont.

The contract for the erection of four residences for Joseph Gray, 500 Gilchrist Street, has been let to Olive & Lane. Brick construction. Estimated cost, $1,800 each.

Quebec, Que.

Work has been started on the erection of a residence for J. Levy, 120 St. Louis Road, by L. H. Peters, Limited, 10 St. Angele Street. Approximate cost, $4,000.

The contract for masonry and plastering for the residence being erected on Aberdeen Street for J. E. Roillard, 38 St. Marie Street, has been let to P. R. Tardif, 260 Napoleon Street. Owner will do roofing, heating, plumbing, and electrical work.

In connection with the erection of a residence at D'Artigny & Ste. Julie Streets for N. Moisan, 23 D'Artigny Street, the masonry and plastering contract has been let to P. Tardif, 260 Napoleon Street. Roofing contract not yet awarded.

The carpentry contract in connection with the residence being built for P. Paradis, 236 D'Aguilon Street, has been let to C. Jobin, 168 Latournelle Street, and the roofing, heating, plumbing, plastering, and wiring contracts to the general contractor, E. Cote, 358-360 Richelieu Street. Painting will be let by the carpentry contractor.

Leon Nadeau, 105 Franklin Street, has let the contract for masonry in connection with the residence being built on Aberdeen Street to J. B. Verrett & Fils, 190 Third Avenue, Limoilou. Roofing not let.

P. Paradis, 236 D'Aguillon Street, has been awarded the roofing contract in connection with the residence being erected on Cartier Avenue by N. Cauchon, 59 Dorchester Street, and the plastering contract has been let to H. Marcoux, 29 Colbert Street.

A residence is being built for Louis Frenette, 78 Cremazie Street, by Frenette & Ratte, c/o owner. Brick construction, concrete foundation, metal roofing. Approximate cost, $4,000.

In connection with the residence being erected on Maisonneuve Avenue by E. Careau, the contract for masonry and plastering has been let to J. B. Verret & Fils, 190 Third Avenue, Limoilou. Carpentry will be done by owner. Roofing not let.

Toronto, Ont.

The general contract for the erection of a pair of residences for Mrs. C. R. Taylor has been awarded to William Taylor, 77 Fuller Street. Brick construction, shingle roofing. Approximate cost, $3,500.

E. Churchill, 3 Orchard Park Boulevard, is building a residence for N. E. Shier, 900 Queen Street E., estimated to cost $3,500. Brick construction, shingle, felt and gravel roofing.

F. J. Rowlin, c/o Office Specialty Company, 97 Wellington Street W., has completed the foundations for a pair of residences on Keewatin Avenue, and has let the masonry contract to Ellis & Son, 320 Mount Pleasant Road. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,000.

The masonry contract for additions to the residence of C. W. Beatty, 121 St. George Street, has been let to W. Hughes, 216 Simcoe Street. Steel and brick construction. Approximate cost, $7,000.

Westboro, Ont.

J. Stitton, Fairview Avenue, is erecting a residence estimated to cost $3,000, and has let the contract for electrical work to S. Lewis.

Westmount, Que.

Work has been started on the erection of flats on Bruce Avenue for J. A. Besner, 238 Elm Avenue, by S. Berlind, 462 Elm Avenue. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $20,000.

The stone and brick work in connection with the residence being built on Western Avenue for Anselme Letang, 4289 Western Avenue, will be done by the general contractor, J. Quinlan, 4412 St. Catherine Street. The carpentry contract has been let to J. Binette, 259 Wolfe Street, Montreal, and the roofing, heating, and plumbing contract to E. Robert, 93 Vitre Street W., Montreal.

Windsor, Ont.
Plans of a double residence have been drawn for L. C. Brooks, 214 Goyeau Street, and the general contract let to W. H. Creber, Erie and Lillian Streets. Frame construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Woodroffe, Ont.
L. Henderson, Roxborough Avenue, is building a residence, estimated to cost $3,500. The contract for electrical work has been let to T. E. Hopson, 217 Slater Street, Ottawa.

Power Plants, Electricity and Telephones

Elizabethtown Township, Ont.
A by-law has been passed by the City Council of Brockville, providing for the construction of a power line into the Township. Clerk, G. K. Dewey, Brockville.

Heward, Sask.
Tenders will be received until July 15th by J. E. Johnson, Secretary to the Heward Rural Telephone Company, for labor only required in the construction of the Company's system. Plans and specifications according to Government standard.

Howard Township, Ont.
Plans for the installation of a hydro-electric system have been submitted to the Township Council by W. W. Pope, c/o Hydro-Electric Commission, Continental Life Building, Toronto. Township Clerk, G. McDonald, Ridgetown.

Niagara Falls, Ont.
The City Council are having plans prepared for lighting Falls View. Clerk, W. J. Seymour.

Ottawa, Ont.
Tenders will be received until 4 p.m., July 13th, by R. C. Desrochers, Department of Public Works, Ottawa, for the supply of the following tungsten lamps:—18,000-40 watt; 1,000-60 watt; 1,000-100 watt; 1,000-150 watt; 12-250 watt; 12-500 watt; 8-750 watt. Specifications with T. A. Hastings, Postal Station F., Toronto, R. L. Deschamps, Overseer, Dominion Buildings, Montreal, and the Chief Architect, Ottawa.

Tenders on the supply of transformers, switches, and equipment will be received until August 3rd by the Chairman of the Waterworks Commission. Plans and specifications with the Engineer, R. L. Haycock, and with the Consulting Engineer, S. B. MacRae, Sparks Street.

Rama Township, Ont.
Plans for the installation of an electric power system are being prepared for the Orillia Water, Power & Light Commission, Orillia.

Smithville, Ont.
The Township Council of South Grimsby have had plans drawn for an electric lighting system. Clerk, F. W. Roberts.

Winnipeg, Ont.
The Board of Control will receive tenders on the supply of electrodes, glassware, etc., until 10 a.m., July 16th. Specifications with the Engineer, J. J. Glassco, King and James Streets.

CONTRACTS AWARDED

La Baie St. Paul, Que.
The contract for a penstock for L'Hospice de la Baie St. Paul has been let to Sherbrooke Iron Works, at $5,000.

Montreal, Que.
A contract for the supply of cable, alarm boxes, etc., has been let by the City Council to Northern Electric Company, Limited, 814 Notre Dame Street W., at $47,955.

Fires

Chicoutimi, Que.
Fire has destroyed a store and residence belonging to Gaudreau & Gagnon. Loss, $30,000, partially covered by insurance. Owners will rebuild.

Hamilton, Ont.
Fire has destroyed the planing mill of Thomas Roussel & Son, Nightingale Street. Loss, $9,000, principally on machinery.

Martintown, Ont.
A. E. Clingen's sawmill has been destroyed by fire. Loss, $7,000, partially covered by insurance.

Richard's, N.B.
A sawmill belonging to H. Boulay, M.P. for Rimouski, has been destroyed by fire.

Ridgetown, Ont.
The farm buildings of J. J. Gosnell, have been destroyed by fire. Loss, $3,500, partially insured.

Stevensville, Ont.
A barn belonging to Jacob Snider has been destroyed by fire. Loss, $4,000.

Miscellaneous

Corbyville, Ont.
The H. Corby Distillery Company, Limited, are in the market for one air compressor, either belt or motor driven, capacity from 100 to 200 cubic feet of air per minute, one brass lined or brass end motor-driven pump, capacity from 40 to 125 gallons per minute.

Hickson, Ont.
The Township Council of East Zorra contemplate the purchase of a quantity of road oil. Clerk, James Anderson, Woodstock.

Kingston, Ont.
A by-law has been passed providing for the construction of an incinerator, at an estimated cost of $7,000. Engineer, R. J. McClelland.

Levis, Que.
The Municipal Engineer, Camille Lessard, has reported that immediate repairs are necessary to the retaining wall at Davidson Hill. Specifications will be prepared. Estimated cost, $4,000.

The Municipal Council have decided to purchase 1,000 feet of fire hose. Clerk, Lionel Lemieux.

London, Ont.
The purchase of a motor street cleaner is being considered by the Board of Control. Clerk, Samuel Baker.

Montreal, Que.
Tenders on the supply of 5,000 tons of asphalt will be received until July 13th by the City Council. Secretary, L. N. Senecal.

Pembroke, Ont.
The Town Council are considering the purchase of a combination hose wagon and chemical engine. Clerk, A. J. Fortier.

Peterborough, Ont.
Fire has destroyed the brick plant of Curtis Bros., Smith Street. Machinery is almost totally destroyed.

Stellarton, N.S.
McNeil Bros., New Glasgow, are in the market for machinery for the manufacture of shells. Estimated expenditure, $75,000.

St. Tite, Que.
The purchase of fire apparatus is being considered by the Municipality. Mayor, J. S. Decarufel. Estimated expenditure, $3,000.

Toronto, Ont.
The Board of Control will receive tenders until July 6th for the supply of one air compressor and motor for the Danforth Avenue car barns. Plans at office of the Works Department, City Hall.

Wingham, Ont.
A. McDougall, Turnberry Township, Wingham P. O., is in the market for supplies required in the erection of a number of cement and steel silos.

CONTRACTS AWARDED

Quebec, Que.
The general contract for grading the site of the battlefield on the Plains of Abraham has been let by the National Battlefields Commission to A. Ott & Company, 611 New Birks Building, Montreal.

Winnipeg, Man.
The Board of Control have awarded the contract for the supply of a steam boiler to Babcock & Wilcox, College Street, St. Henry, Montreal, at $2,500.

The Ottawa water-supply project is going to be undertaken. The Board of Water Commissioners have decided to call immediately for tenders for the construction, to cost not more than $475,000. The plan proposes to use water from the Ottawa River unfiltered and to build a pumping station, with two units, at Lemieux Island. The water will be carried across the river to the city in a pipe line either on a bridge on in conduit. J. B. McRae, one of the formulaters of the plan, has been retained by the city to supervise the design and construction.

Meetings of engineers are to be held in San Francisco from Tuesday, September 14, to Saturday, September 25. The Road Congress, under the joint auspices of the American Highways Association and the American Road Builders' Association, is to continue from Tuesday, September 14, to Friday, September 17, inclusive. On September 16 and 17 are to be held conventions of the four national societies of Civil, Mechanical, Mining and Electrical Engineers, each society meeting separately. Saturday and Sunday, September 18 and 19, are to be devoted to excursions to points of engineering interest in San Francisco and vicinity. The following week, from September 20 to 25, is given up to the International Engineering Congress.

Late News Items

Ailsa Craig, Ont.
A by-law has been carried providing for the installation of a hydro-electric system. Town Clerk, J. S. Smith.

Calgary, Alta.
The City Council have had plans prepared for two comfort stations, estimated to cost $14,000. Engineer, G. W. Craig.

Dufferin County, Ont.
Tenders on the construction of five concrete bridges will be received until 1 p.m., July 9th, by Wheelock & Christie, Engineers, Orangeville. Plans and specifications with the Engineers.

Elmwood, Man.
The following contracts have been let for the erection of a picture theatre on Kelvin Street for M. Gonsalves, 160 Eugene Street, Norwood:—masonry, Woodall & New, 54 McAdam Avenue; carpentry, Pattie & Cosham, 489 Victor Street; plastering, Cooper & Sons, care of Roberts & Frith, Engineers, Canada Building, Winnipeg; heating and plumbing, Jonees & Creighton, Harbison Ave.; electrical work, Schumacher Grey Company, 386 Donald Street; sheet metal work, Elm Sheet Metal Works, 20 Levis Street.

Exeter, Ont.
The Town Council will shortly submit a by-law providing for the installation of a hydro-electric system, estimated to cost $20,000. Acting Clerk, J. Senior.

Hagersville, Ont.
Tenders on the construction of concrete sidewalks will be received until July 12th by the Village Clerk, J. T. Park. Plans and specifications with F. E. Shildrick, Chairman of the Board of Works, and at office of the Clerk.

Hastings County, Ont.
The County Council have recommended the construction of a number of bridges. Clerk, A. M. Chapman, Belleville.

Montreal, Que.
Tenders on underground cables at the Flitration Plant will be received until noon, July 20th, by the Board of Commissioners. Plans and specifications at office of the Chief Engineer, City Hall.

Nanaimo, B. C.
E. J. Breseman is receiving tenders on plastering, plumbing, wiring, hot water heating, painting and decorating, marble and tile work, roofing and metal work, fire escapes, electric fixtures, stage equipment, opera chairs, mission tile, art and plate glass, and mirrors, for a theatre to be erected on Bastion Street.

Port Alberni, B.C.
The Presbyterian Church has been completely destroyed by fire. Loss, $6,000. Pastor, Rev. Thomas Oswald.

St. Vincent Township, Ont.
Tenders for concrete abutments for a bridge on the Eighth Concession will be received until July 10th by James A. Lemon, Meaford.

Toronto, Ont.
R. M. Mishaw, care of E. W. Mishaw, 269 College Street, has commenced the erection of a pair of residences at 52-54 Manor Road, estimated to cost $7,000.

Work has been started on the erection of two residences at 165-167 Glendennan Avenue, by T. W. Robinson, 11 Evelyn Crescent. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Vancouver, B. C.
G. B. Barker, 835 Tenth Avenue, has started work on repairs to a warehouse at 1150 Hamilton Street for J. W. Percival, Canada Life Building. Approximate cost, $22,000.

Local assessments for mosquito extermination in portions of New York City are authorized by an act of the New York legislature which is to take effect immediately. The act, which is an amendment to the city charter, as as follows:—

The cost and expense of the construction of drains upon or of other improvements to low or wet lands in the boroughs of Brooklyn and Queens, for the elimination of mosquitoes, by the board of health, shall be borne by the property benefited within an area of benefit to be fixed by the board of assessors, or such portion of the amount of such cost and expense as the board of health may determine and certify to the board of assessors. Assessments therefor shall be made by such board of assessors as provided in chapter seventeen of this act.

The flow of the Colorado River is sufficient to irrigate the entire Colorado delta, according to a report made by C. R. Rockwood, Chief Engineer of the Imperial Irrigation District. Twenty-three years ago, in 1893, Mr. Rockwood stated that the Colorado River furnished sufficient water to irrigate every acre on its lower drainage basin to which water could be applied. Data now available permit a much more comprehensive and complete report. Mr. Rockwood finds that the area which may be irrigated with the flow of the Colorado River at minimum stage varies from 4,672,000 acres in June to 829,000 acres in September. Below The Needles, Mr. Rockwood estimates that 1,700,000 acres may eventually require water. Long before this entire amount is brought under cultivation, however, it will be feasible to provide storage reservoirs on the upper tributaries of the Colorado for the impounding of flood waters; and with this done, the river can furnish an absolutely safe supply for the months of July, August, September, and October, which are the only months in which the normal flow of the river might be inadequate. His final conclusions are that the river without storage can irrigate 1,200,000 acres, and with 2,000,000 acre-ft. of stored water every available acre below the Grand Canon, including all lands in Mexico, could be irrigated. Even without storage and this entire area under irrigation, the worst that could happen in a year would be the loss of one or two cuttings in alfalfa on a part of the land. —Engineering News.

It is an old and doubtful saying that "lightning never strikes twice in the same place." When it does strike, however, it causes destruction and death. During the month of April, throughout central and eastern Ontario and western Quebec, no fewer than 61 buildings were destroyed or damaged by lightning. It is doubtful if any of these buildings were protected by lightning rods.

Isolated and exposed as they are to the danger of lightning, it seems remarkable that so few farm buildings are equipped with this cheap and efficient protection.

Lightning rods have proven their efficiency. Many buildings owe their protection entirely to the fact that they were rodded, and losses on these buildings have been reduced to a minimum. According to W. H. Day, Professor of Physics, of Ontario Agricultural College, "out of every thousand dollars' worth of damage done to unrodded buildings, by lightning, nine hundred and ninety-nine dollars' worth would be saved if those buildings were properly rodded." This opinion is based on data compiled from investigation and reports covering ten years and including a record of 599 buildings that were struck by lightning. Of these 317 were burned, or 53.6 per cent. Of the 599 buildings only 18 were rodded, and of these three were burned, or 16.6 per cent., as against 53.6.

When it is understood that the losses to the insurance companies in Canada, by lightning, approximate a halfmillion dollars annually, and that this represents probably less than half of the total loss, the necessity of more adequate protection to farm buildings is apparent.

Some records of lightning rod efficiency follow: In Ontario for 1912, 94½ per cent.; for 1913, 92 per cent.; in Iowa, for eight years, 1905-1912, 98.7 per cent.; in Michigan, inspected rods showed an efficiecy of 99.9 per cent. fof four years, 1909-1912, inclusive. These figures are worthy of the careful consideration of the residents of the rural districts of Canada.

Further information on the subject of lightning rods and their efficiency may be obtained in Bulletin 220 of the Ontario Department of Agriculture, supplied free to those interested.

Coal gas residuals form the bases of many industries. Owing to the great development of by-product coke ovens and gas plants in Germany and the application of modern chemistry to the utilization of their by-products, these industries have largely been controlled by that country. In the readjustment of industrial and trade conditions after the war, it is desirable that as many of these industries as possible be established in Canada and in other parts of the British Empire.

There are two large by-product coke ovens in Canada which produce 67 per cent. of our coke output. These plants are situated at Sault Ste. Marie, Ont., and at Sydney, N. S. Since the outbreak of war, the latter plant has been installing a benzol recovery plant, but, in Western Canada, there are numerous beehive coke ovens which do not save any by-products whatsoever. Again, while large quantities of tar are recovered from local gas plants, no industries have been established for the refining, separation and use of the products obtainable from it.

Not only is the saving of the by-products from the coking or carbonization of coal a measure of conservation, but the sale of these residuals is the means of reducing the cost of production in a degree corresponding to the efficiency of the recovery methods adopted and the market value of the products.

Tenders and For Sale Department

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Incandescent Lamps, Public Buildings, Ottawa, Ont., will be received at this office until 4 p.m., on **Tuesday, July 13, 1915**, for the work mentioned.

Tenders will not be considered unless made upon forms supplied by Department and in accordance with conditions contained therein.

Specifications to be seen on application to Mr. Thos, A. Hastings, Clerk of Works, Postal Station "F," Toronto, to Mr. R. L. Deschamps, Overseer, Dom. Bldgs., Montreal, and to the Chief Architect, Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. Desrochers,
Secretary.

Department of Public Works,
—81952. Ottawa, June 28, 1915. F

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Superstructure of the North Timiskaming Bridge, Que.," will be received at this office until 4 p.m. on **Monday, July 12, 1915**, for the construction of the superstructure for a bridge consisting of four spans, over the Quinze River at North Timiskaming, Pontiac County, Que.

Plans and forms of contraet can be seen and specifications and forms of tender obtained at this Department and at the offices of the District Engineers, Shaughnessy Building, Montreal, P. Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Hamilton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

Note,—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 19, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—80239. 27

Tenders Wanted

Tenders will be received up to 6 p.m. **Saturday, July 17th,** for the construction of the substructure and superstructure of a Highway Bridge over the Madawaska River at Burnstown in the County of Renfrew, Ontario; tenders to be addressed to P. H. Bolger, Chairman Roads and Bridges Committee for the County of Renfrew, R. M. D. No. 2. Renfrew, Ontario.

Plans and specifications may be seen at the office of J. L. Morris, County Engineer, Pembroke, and J. A. Devenny, Town Clerk, Renfrew, Ont., on or about the 1st July, 1915.

The lowest or any tender not necessarily accepted.

ROBERT J. RONEY,
27-28 Clerk of the County of Renfrew.

TOWN OF OAKVILLE

Pumping Machinery

Sealed tenders will be received by the Chairman of the Oakville Water & Light Commission until **8 p.m., on Monday, July 26th, 1915,** for furnishing and installing one electrically-operated turbine pump of 600 Imperial gallons capacity against a head of 300 feet.

It will be necessary for bidders to visit Oakville and inspect the existing pumping station.

Specifications may be seen at the office of the Commissioners, Oakville, or at the office of the Engineers, 204 Mail Building, Toronto.

The lowest or any tender not necessarily accepted.

C. G. MARLATT, Esq.,
Chairman, Oakville Water & Light Commission,

CHIPMAN & POWER,
27 Engineers.

Tenders for Construction of Bridges

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, July 20th, 1915,** for the construction of:

1. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, Con. VI., in the County of York.
2. Reinforced Concrete Slab Culvert of 12 ft. span, between North Guillimbury and Whitchurch Townships, between Con. VIII. and IX. East, in the County of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
County Engineer.
Toronto, June 29th, 1915. F

FOR SALE

Complete shop outfit, consisting of:—
One 10 x 15 Iron Shaper;
One Pedestal Emery Stand;
One 20-in. Square Base Champion Drill;
One 14 x 28 Fay & Scott extension gap lathe;
One 8 H.P. Gasoline Engine;
Together with belting, shafting, hangers, and pulleys.

This machinery in first-class condition. Box 213, Contract Record, Toronto. 25-27

Mixer Wanted

Concrete batch mixer, also heavy timbers and scantling, second-hand. Give full particulars and price. Box 221, Contract Record, Toronto. 27

In many cities and towns of Canada, the annual clean-up day has been observed. Refuse and litter have been removed. Yards have been tidied up and made presentable. This result has been secured through the active agitation of public bodies and private individuals interested in the sanitary and clean-city movement.

But why should this laudable effort be restricted to annual clean-up days?

In Canada, owing to the conerivg mantle of snow which hinders the complete remoal of garbage and other refuse, there is some slight excuse for the untidy conditions found in the spring. As this excuse is not applicable, however, during at least eight months of the year, there is no reason why, after the spring clean-up, the improved conditions should not be continued.

The cultivation of civic pride is a necessary factor in the clean-city objective. The officers of municipalities, and especially the newspapers, have it in their power to create and foster this spirit of pride. With the incentive of respect for the home town, it becomes a duty of first importance on the part of its residents to see that its roads, sidewalks and open spaces are kept clean, to protect its trees, and in every way possible to preserve and beautify their homes.

The proper interpretation of forestry, and what it actually means to Canada, cannot be stated too frequently. The future of this country depends upon our making every acre productive. Broadly speaking, the earth's surface can be made productive in two ways only, by producing agricultural or timber crop. South of the 60th parallel, about 69 per cent. of the area of Canada is unsuited for agricultural crops. A very large proportion of this non-agricultural land is suitable for the production of merchantable timber. The production of forest products has been and will always be one of our chief industries. At the present time forest industries supply 12 per cent. of our foreign trade, 16 per cent. of our railroad traffic, and equal in value our annual wheat crop. We have a choice to make. Shall we let these valuable industries perish for want of raw material or shall e perpetuate them by protection of our present mature timber from fire, by protection of the young forests of our non-agricultural lands, and by the logging of our forests in such a manner as to encourage the reproduction of valuable forests? The perpetuation of these raw material by the investment of such expenditure as the anticipated crop will warrant is forestry.

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The Time for Civic Improvements

IN this country the need for doing effective town planning work is apparent. Our towns and cities are now in the process of growing up, and we have every opportunity to profit by the experience of the cities of the old world, who find their cramped streets and slums such a difficult problem. If all Canadian cities were of one mind in the matter we might soon have urban districts that would be a bright example to the rest of the civilized world, but unfortunately many cities that have now attained a considerable size have allowed themselves in their rapid growth to go rather a long way in the wrong direction, and it will be only by taking advantage of the present lull in the rush of business activities that they will be able to place themselves in a strong position as well-built cities.

Ordinarily our organization has been such as to demand constant and speedy growth. There has been little time to consider how this growth might be regulated or guided along reasonable lines. Business blocks have been rushed up without sufficient attention to the fire hazard; real estate values have been inflated, and as a consequence workmen's homes have been crowded together until the districts inhabited by them have come even to have a resemblance to the slums of the larger cities of Europe. Apparently, no one has considered the future, or whether if the conditions are ever to be improved the money will be found to make them.

Now that things are quieter, there is time for reflection. It is true that there is little money to spare for the improvements so sorely needed, but this very fact has opened the eyes of many to the unnecessary expense incurred by letting things slide in the first place to be remedied at some later date. Hard times have drawn attention, also, to the undertaking of municipal improvement work as a means of providing employment, and now that money is less easy to get than formerly city authorities are beginning to realize what the improvements will cost by reason of their having been allowed to remain undone until the city has reached large dimensions. Fortunately this condition is characteristic of only a few of our cities, but their experience cannot be presented too strongly for the benefit of the small towns, and even villages, which we know well may be tremendous cities at no very distant date. Tremendous city or not, however, the need for proper regulation of the growth of a town remains if we are to take full advantage of all the possibilities for healthy conditions provided by the nature of this country. It is not a question of size: the whole matter can be resolved down to a question of the good of every individual. In a large city there are more individuals to be provided for, it is true; but that is just a matter of proportion. The individual should have as healthful surroundings in the large city as in the country village, if we are to realize the ideal of all town planning.

The present period of business depression, which has served to draw our attention to the direction in which our headlong pursuit of wealth was leading us, may also serve to direct our thoughts towards the rectification of some of our errors and to the formulation of a few good resolutions for the future. When the average factory gets through a run of rush work the management generally find it necessary to have a clean-up, and if they are at all inclined to make the most of their opportunities they re-organize their operating system with a view to minimizing the clean-up work that will be necessary after another such rush. A similar course should be taken by our municipal authorities: now is the time to recognize deficiencies in the working of systems, and to improve them to meet the requirements of modern social conditions.

This work is being made the easier for the individual municipalities by the organization, by the Dominion and some of the Provincial Governments, of departments to look after the preparation of work in town planning schemes. By the recent Western tour of Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation at Ottawa, a great deal of interest has been aroused in the cities of the prairies, and it is hoped that this interest will develop into action. If the larger cities will take the lead the smaller ones will follow. It is in the West, too, that town planning projects can be introduced at a most opportune time, for, although the cities have grown up rapidly, they have not been built so solidly wrong, if one may use such a term, as the Eastern cities, which have been built more after the European style. Winnipeg has made a good start: few Canadian cities have such wide main streets in the business districts. For some time there has been a Housing and Town Planning Association, and now there is a Committee of the Industrial Bureau on Town Planning and Civic Betterment to further schemes for improvement in various civic lines. A permanent body known as the Greater Winnipeg Plan Commission has been appointed to take official charge of the work of planning and re-planning.

The Commission is now preparing a plan covering the whole district, so that the city can work to this plan as it develops in the course of time. The area to be covered by the scheme—Greater Winnipeg covering over one hundred square miles—is considerable, but it affords the room for the working out of an undertaking that will make Winnipeg, not only the largest city of the West, but also the best from all points of view. As noted recently in The Contract Record, Mr. Paul Schioler, the City Bridge Engineer, has prepared drawings for the three new bridges which the city intends to build, and in the preparation of these preliminary designs engineer and architect have co-operated to produce bridges suitable in structure and pleasing in appearance.

What Winnipeg is doing is an example of what all our cities and towns should be doing according to their several necessities. Money may be tight, but what we do in connection with town planning to-day will benefit those who come after us. They would have to improve where we have not improved or have let things slide, even as many of the cities of the old world have had to do. If we do our duty in the present there is no reason why the cost should not be spread over a number of years, and the expense will not be so heavy as if the improvements were deferred so long that they became difficult to make. The whole spirit of the necessity of the undertaking of town planning measures at the present time is expressed thus, because it is cheaper to put them into effect to-day, even though money is not so plentiful. Works such as these can be financed without much difficulty so that the burden can be spread over a long period, or at any rate carried along until more prosperous times for disposal.

In addition to its connection with the relief of unemployment, the desirability of undertaking these works now is apparent when we consider what has been the case in the past. We have been too busy growing to care much how we grew. We shall be too busy in the future to pay the necessary attention to the matter unless we organize the whole of the work so that it becomes part of the cities' natural growth. It is useless to make good resolutions and defer their carrying out until the outlook is brighter; they are too likely to be overlooked, as in the past. Now is the time to act, and all our municipalities should back up the Dominion and Provincial Governments in their efforts to make our Canadian cities and towns something for us to proud of. This may entail some sacrifice, but our reward will come in added pleasure in life and the greater prosperity that attends live, well-run cities; and we shall have the additional satisfaction of knowing that we have earned the gratitude of succeeding generations.

Signs of Revival

WHILE only 213 building permits, of a total value of $1,024,115, were issued in the city of Montreal for the month of June, as compared with 549 permits of a value of $1,943,596 for the same month of 1914, it is interesting to note that the figures for June are the best of the year. The previous best month of this year was April, with permits of a value of $973,891. The total figures for the first six months of the year show that 1,161 permits of a value of $3,419,109 have been issued, as against 2,372 permits of a value of $8,521,910 for the same period of 1914. Though the total figures for the half year are behind those for the first half of 1914, it is evident that a considerable revival is under way, and, while Montreal seems to be more favorably placed in this respect, the improvement only reflects the general trend of things throughout the country.

Non-Slip Bitulithic Paving

THE Twelfth Street hill at New Westminster, B. C., now being laid with a bitulithic carpet, will have a non-slip surface. It differs somewhat from the bitulithic paving in use on the flat in several important details, the effect being to afford horses a better foothold than can be had on most paved streets on heavy grades.

The ordinary bitulithic process, in the case of carpeting a sound macadamized road, is as follows: The road is scarified to a depth of three inches, having been first flushed. An inch and a half of new rock is added to the rock loosened by the scarifying process, and the base thus formed is rolled and sprinkled with bitumen in order to form a bond with the 2-inch top, which is spread on in two layers rolled separately. This top is composed of the usual bitulithic mixture of small stone, sand and bitumen, and is put on at a temperature varying from 220 to 250 degrees Fahrenheit, according to the weather. In hot weather, which is better for this work than cold, the mixture need not be so hot. On top of all is spread a squeegee coat of fine stone ¼ to ⅛ inch, rolled in, and the road is finished.

On the hill, however, the process changes when the top has been rolled in. There follows a mineral flush coat of small stone coated with bitumen, rolled in, and the final squeegee coat of ¾ in. stone.

The improvement of Twelfth and Columbia streets is of importance, also, as marking a practice not hitherto employed to any extent in the New Westminster district, viz., that of carpeting macadamized roads. By this method the solid foundation of a good macadamized road is not wasted when it is decided to pave. Already some of the surrounding municipalities have sent representatives to inspect the job, and it is likely that should it bear out the claims of the paving people the method will come to be rather extensively used in the neighborhood.

Beautifying Our Streets*

By Prof. A. A. Stoughton

FOR the last few years we have been so industrious in telling city officials and commissions that city planning does not mean the city beautiful that we have almost persuaded ourselves that this is true. We have been so much concerned with street widths and angles of light and building laws and subsurface structures and areas of courts that the opportunity to discuss beautiful architectural accessories of city planning comes to me as a pleasant surprise. This country is making rapid progress towards fulfilling the scientific requirements of our trade, because so much planning is being done in the light of highly organized study. It is relatively easy to fix the width of streets and not impossible to tell how far apart to put them in a given case; the books will tell how to orient them. There are more and more instances of good street planning in this country, because more new districts are being laid out here than elsewhere; and we have plenty of competent men. But such good work, with all its merit and its scientific accuracy, leaves the man in the street cold. Only a city planner raves over a fine scheme on paper or made "concrete" only in walks and curbs and pavements, because he only can visualize its total effect in beauty, which may never be fully realized. I have in mind a grand avenue, recently constructed in upper New York, 250 feet wide, with all the potentiality of an Avenue des Champs Elysees, which should have become lined with fine residences, but on which the high property values created justified nothing short of tenement houses. It is this total effect in beauty which we are to consider briefly.

City planning, being so comprehensive, cannot consider its duty discharged until its street system is given its proper natural and architectural setting or background, until it is furnished with the necessary fixtures conceived in an artistic spirit, and enriched with objects of sentiment and beauty for the enjoyment of all. What would the streets of most European cities be, fine as their buildings are, lacking the fountains and statues and columns, the commemorative tablets and monuments, which speak in varying language to the passer-by—of patriotism and glory and history; of science and art; of the things of the mind; of local pride; of aspirations and moral values; of humor and gaiety; of religious faith and of life and death—running the gamut of emotions, appealing to every sentiment and stirring thoughts in every cranny of the mind? We think of many towns only in terms of their ornamental features, without which the towns would be uninteresting and bare, like an unfurnished house. More than anything else, this furnishing of the streets with objects making a varied appeal—the gathered mementoes of the past, the artistic heritage of local and race history and achievement—gives a place a personality and an intimate and hospitable character.

From earliest times it has been a most natural custom to decorate the highways and public places with memorials. Our minds run back to the avenues of sphinxes, the obelisks, and the figures of men and animals, symbolizing the gods of Egypt. Among the Greeks and Romans, the votive offerings, the religious figures, the effigies and war memorials and edicules of various kinds, added greatly to the interest of the streets. The Romans were decorators of the public places, their architecture supplying the finest setting possible in the noble colonnades and porticoes, uniting all the separate features into a harmonious piece of decoration. The altars and rostra, the statues of emperors and gods, the columns and triumphal arches, have each a part in the composition. This fine tradition was followed by the Italians of the Gothic period and of the Renaissance, whose spires and campanili and fountains added a different though no less decorative note. The enrichment of the street picture was not by any means peculiar to the sunny southern countries where the open air life is natural. Northern places have held the same custom, and especially in modern times, with expanding resources, they have beautified the setting of their life. In the smaller ones we have a fountain, market cross, a wayside shrine, a figure of the local hero or the glorification of a signal event. In the larger ones we have an Arc de l'Etoile, a Fontaine de l'Observatoire, a Pont Alexandre III., an Albert Memorial, a Thames Embankment, a Scott Memorial, a Sieges Allee, a Kaiser Wilhelm I. Monument, a Victor Emmanuel Monument, a Washington Monument, Grant Monument, and the like, of too many species to mention even the types.

In the logical development of a town the necessaries come first—fixtures for lighting, standards for carrying wires and signboards, mail and fire alarm boxes, receptacles for waste, benches, shelters and waiting stations, drinking fountains for man and beast, kiosks for vending and advertising, public conveniences, entrances for sub-surface structures, bridges and elevated structures. All of these utilities must, of course, be treated decoratively so as to be agreeable in form and to harmonize in scale and character with their surroundings. In many cases the original useful purpose is merged in the decorative, and certain of them—as fountains, for instance—exist for the latter only. In the next class may be put such conveniences as ramps and steps, retaining walls, bridge approaches and waterside constructions generally, city gateways, park enclosures, towers for beacons or bells, clocks and sundials, bandstands and pavilions, which present an even more natural appeal for artistic treatment. Then there are all the resources of nature, the plantation of mass and surface, the green of the tapis vert with the glow of the parterre, and the sparkle and tinkle of water. Then come the purely ornamental features, in which art and sentiment join hands to add the highest touch of grace to the street picture, varying in a wide range between the boulder bearing an inscription and the triumphal arch or the many-figured group. Finally, above all, there is the embellishment of the buildings, private or public, which line the streets or occupy open spaces, and make or mar them. This phase of the subject is outside the scope of this paper, but I may say that if buildings are to enter into the decorative scheme of the streets they should at least be visible. It is sad to think how much of the possible effect of fine buildings is never realized on account of our long, narrow streets and the rigid adherence to the rectangular block. For buildings, as for monuments, a short vista gained by cutting off or turning a street or broadening it into a decorative place is necessary. I come from a place which glories in the possession of several fine avenues 122 feet wide, giving unusual opportunities for architectural effect. One of them is notable as being the longest street in the world. But although running nearly straight for 825 miles, it turns as it crosses another principal avenue, and is faced on the latter by a fine building, which therefore has its full effect. Perhaps I should add in another category those embellishments for which former times give no precedent, which are the most obtrusive and insistent of all, and from which the most enlightened society has so far been unable to protect itself—the advertisements. I will say only that the state which finds a remedy for this outrageous evil, which renders nugatory all beauty in our streets, deserves a reward equal to that of the man who conquers cancer or typhoid.

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* Paper before the recent Town Planning Convention held in Detroit.

There are no rules for designing street features except those applying to other works of art. The book of suggestion is wide open in the aspect of foreign cities and towns. When we turn its pages we find an astonishing variety in the choice of motive, in treatment and in placing. Every problem of treatment and adjustment has its own special conditions and its own best solution by which the object shall be related most agreeably to its purpose and site and surroundings to give it individuality and distinction. To pass about the Grand Boulevards and along the great east-and-west axis of Paris—one of our most common mental promenades—gives a most complete exposition of the subject. We see the monument, isolated or adosse, the column and obelisk, the architectural setting of sculpture, the group and equestrian statue, the fountain and pool, the triumphal arch and the city gate, the decorative avenue leading up to a monument or building, open places of various sorts, the splendid building enhancing and being enhanced by its surroundings, the careful use of the green of nature, the color of flowers and the flow of water, the variety of effects of changing angles of view, the terraces and balustrades and ramps and bridges.

Our cities will scarcely put on the garment of beauty and wear it with an air of ease and accustomedness until our people gain that real culture which shows itself in the appreciation of the fitness of things. Now, even in places where objects of art are set up, we often see glaring and ridiculous contrasts, like a man in full dress with tan shoes or with dirty hands. I have in mind an example of this, where, in one of the most fashionably frequented city squares in America, opposite one of our proudest hotels, there stands an island which was decorated with a bronze lamp, specially designed, provided by an art association. The man who operated a switch near by had made himself comfortable by installing against this lamp a dilapidated rocking chair, which was kept in countenance by a battery of street-cleaners' rubbish cans, brooms, etc., as a permanent furnishing of the spot.

But without a culture and love of beauty for its own sake, and basing our plea on a lower plane, we should accomplish more if we could convince the authorities of the money value of civic art. Just as many foreign products command a high price purely for the element of beauty of design in them, so a beautiful street or square or bridge or building or monument raises the value of real estate in the vicinity, while a city which as a whole is organized on attractive lines draws people and business enterprises to itself, has its fame carried far and wide by every chance visitor, and recoups itself directly and indirectly for the outlay many times over. Beauty as an asset convertible into real estate values and tax returns is recognized by most foreign cities—not yet sufficiently by ours. As soon as our people realize this they will, of course, hasten to invest in public art.

We of this country are fortunate in that few monuments have been inflicted upon our cities, and that other fixtures are not of a very permanent nature. Sculpture has developed as rapidly as architecture in the present generation, and we are now for the first time in a position to memorialize great deeds and events by monuments that future generations will not feel like removing to sequestered depths of the parks. Sunset Cox hailing a trolley car on Fourth Avenue, New York, will hardly have any replicas, to mention but one artless object set in a high place. Despite the absence of art commissions in many places and of competent committees for the erection of memorials, much better work is being done by reason of the general elevation of intelligence which impels committees to seek expert advice in such matters, and because better talent is available. It is far better to leave our streets and parks bare of everything but the necessaries for a long time than to fill them with meretricious ornaments, debasing rather than elevating taste, setting a low standard and pre-empting good sites, as it is practically impossible to dislodge them on the score of bad art once they have dug themselves in. It is well to proceed slowly. All cities and towns, large or small, should be urged to appoint art commissions, or at least to secure competent advisers for special occasions, and all such experts should be encouraged to do their whole duty in maintaining the highest standard in civic art.

The placing of works of art with us is specially difficult on account of the paucity of good sites furnished by the gridiron plan, unmitigated by studied modifications or accidental irregularities. Our street system reduces us to the necessity of placing our ornamental features, other than those in parks, against buildings or near them, or along the edge of parks facing sidewalks, seen as we pass by, not as we approach along a vista. This may be well enough for small and minor objects, if we have enough of them to spare for inconspicuous places, but the wisdom of grouping these things, whether they be few or many, is generally conceded. For larger schemes and formal arrangements the city planner must create sites and provide vistas for the architect and sculptor and the gardener to use. When we see the marvellous impressiveness and dignity of the Place de la Concorde or the Kaiser Wilhelm Platz—the distinction each gives to a whole city—or the fine effect of many smaller squares which may be simply the widening of the highway, artfully shaped and treated, it is strange that our new cities, while they are in the making, should not provide such advantages for the future. As traffic places, or resting spots for pedestrians, or accents in a general effect, or opportunities for formal embellishment, they would be invaluable.

Our planning, or our city growth without plan, has not taken into account the amenities of street life—the chance to pause in the mad rush to get a glimpse of nobler things than trolley cars; to get a new hold on common life by a suggestion of greatness from a monument or of grace from an object of art; to get the uplifting effect of a noble colonnade or tower seen at the end of a vista, or to get a refreshment of mind from the greenness of ordered trees or sward. It has sought only to furnish the greatest number of rectangular blocks. It is time for a new idea to replace this one. The city planner and the monumentalist must co-operate in creating sites capable of a decorative setting and of furnishing them suitably as time goes on as places for the display of the city's sentiments and ideals and taste and for the elevation and distinction of its life. Our inspiration is in the fountain of art; our copybook is the achievement of the past; our teacher, the artistic instinct of the ages.

The Correction of Common Deficiencies in Public Works Reports

A study of the public works reports of different cities discloses a wide variety of treatment and make-up, from the bulky volume with more than a thousand pages to a collection of tables that require a cipher code for their interpretation. It is evident that one or the other or both of these presentations must be wrong. They indicate a lack of conception of the purpose of a public works report.

To be successful it is evident that the purpose of a report—to give citizens information as to the expenditure of public money for public works—must be kept clearly in mind. If the citizen body were composed of those having but a single interest, or if all could be interested in a similar manner, the preparation of such a report would be simplified. But a diversity of interests must be recognized, and the information presented so as to satisfy different requirements, for it is clear that if the manner of presenting the information is such that it cannot be understood by the audience to whom it is addressed the report will fail of its chief purpose. It is therefore necessary, first, to analyze the various requirements of the readers of public works reports.

It will be admitted that these requirements are dependent upon the character of the audience to be addressed. In general the citizen body comprising the audience of a public works report may be divided into three main classes. In the first class are those citizens who have an interest in the activities of their community but who wish for only general information. This class constitutes numerically by far the largest portion of the audience. The second class is composed of citizens interested in a more detailed financial study of the city's activities, such as administrative officials, members of civic organizations, and a few others who would study a report closely. The third class, interested in technical matters, is made up chiefly of engineers within the city and engineers in other cities.

Public works reports in the past have, in general, recognized this division of interest, but seldom has any public works report been compiled with these three distinctions clearly in mind. The result has been that some reports are especially good in a general way, giving matters of general interest but lacking details that are of value to the student of municipal affairs. Other reports give only a mass of statistical detail that has little meaning and less interest to the average reader.

Creating Interest Through the Press

It will be recognized that a most important function of a report is to command as much general interest among the citizen body as possible. Usually the reports, necessarily limited in number, will reach the hands of but few, and if the contact of the citizens with the report were the only means for them to gain information little would be known as to the activities of the city. The channel through which information must come is the newspapers. If, therefore, the information for the general reader is to be in proper shape, a public works report should contain a clear, concise, general review, free from technical language and confusing detail, occupying space not to exceed three or four newspaper columns. Suitable headings and subheadings should be used throughout the report.

This portion of the report should constitute the opening chapter, presumably written by the administrative official in charge of the public works of the city. Information prepared in this manner would then be available in convenient form to be excerpted bodily by newspapers and thus relieve newspaper men of the necessity of reviewing the whole report. In doing this there is a possibility of missing essential features and dwelling at length on unimportant details, for it must be assumed that the head of a public works department must know the relative importance of the activities of his work better than any one else.

Aside from a general review of the entire public works of a city, the report of each bureau, in turn, should have an opening chapter outlining the activities of the particular bureau but entering somewhat more into detail than would be practicable in the general outline, at the same time being free from technical language and confusing tabular matter. Thus it would be possible, aside from a general story of the public works department as a whole, to obtain special stories of each division or bureau of the department.

To compile these portions of the report will require more care and judgment than any other part if the relative importance of the various activities is to be presented to the public so that a true perspective of the whole may be had. At times, with public interest centred on some special work, it will be necessary to describe such a feature in greater detail and length than would ordinarily be required. Again, the necessity of certain improvements which are foreseen by the officials and not realized by the public in general may require special emphasis.

The information desired by the second and third classes of readers, as previously outlined, will necessarily overlap, and it would be impracticable to divide a public works report or portions of the report into two divisions for the primary purpose of supplying separately for each of these classes the information they would require. It will be sufficient in compiling the report that the information these readers seek be presented in logical sequence and as fully as possible.

A tabular arrangement of facts and statistical data should be employed, but each table should state clearly just what it is and make unnecessary a study of the text to explain it. Statistics of expenditures and quantities of work done and costs of work are useful only from a comparative standpoint, so that tables showing only the results for a single year are of little value. Such tables should give data extending over a period of years, and thus make a comparison possible.

Diagrams frequently give the reader a better comprehension of certain facts than can be done by tables, and should be freely used; but, as with the tables, each diagram should be lettered so that with its title its meaning is self-contained.

Typographical Appearance

The readability of a report depends in no small degree on its typographical appearance. The casual reader often avoids the perusal of a report because of its uninteresting appearance. The use of fine type, closely leaded, no suggestive headlines to break up the solid mass of text, few or no cuts to attract the eye, all combine to produce such an effect.

A report, to be readable, should be in clear, good-sized type on a convenient sized page. Frequent headings in larger sized type should be used, while chapter headings would be distinguished by still larger and bolder faced type. It is recommended that the body of the report should be of clear-faced, ten-point, Roman type, and well spaced, averaging about five and one-half lines of print to the inch. The size of forms or printed portion of a page should be 4 to 4½ ins. in width and 7 ins. high. There should be left a margin of not less than ¾ in. on all sides, while a 1-in. margin is better.

Cuts, to be of value, should be clear, made from good photographs, printed on highly calendered paper and of sufficiently fine line so that detail will not be lost. Where paper of a good quality is used for the cuts the screens used in the photo-engraving work should have at least 133 lines and may have 150 lines to the inch. In either case ink of good quality is necessary. Full size page cuts will be found far more satisfactory than reduced sizes crowded two or three on a page. Where cuts are used they should be selected to bring out clearly the point desired so that one may look at the picture, read its title, and get the meaning without necessarily referring to the text. In some classes of work it is well to arrange a series of cuts that will tell the complete story of a process or construction, as the case may be.

Reproduction of Diagrams

Diagrams, to be useful, must be easily readable. As a rule, diagrams are reduced from larger drawings, which will not stand much reduction because the usual lettering upon them, when reduced, will be too small to be read clearly. Generally it is desirable to redraw diagrams that are to be reduced, exaggerating the lettering so that when reduced it may still be of a size that will be read easily. Bolder lines should be used and conventional detail exaggerated so that there may be no mass of lines which will print with a muddy effect when reduced.

Inserts for tables should be avoided where possible; they spoil the appearance of a report, are disagreeable to use; and generally become torn and detached from the report itself. However, their use is sometimes imperative, and where necessary care should be taken that all the inserts are placed in the report to face the same way. For those tables that must be compared with the text it is desirable that, when unfolded, there should be a blank strip left at the margin sufficiently wide that the printed table may appear to one side entirely clear of the page. This, perhaps, applies more to tables that would appear in textbooks than to most tabular statements that would be found in a public works report. Tables may be printed in much finer type than the body of the text, the size of the type being determined by the extent of the table. It is not advisable, however, to use less than six-point type.

Appendices may be set up closely leaded in eight or even six-point type. Six-point type with lines spaced with two points of lead will be found more easily read than eight-point type not leaded.

Few care to keep in a library a paper-bound book. If, therefore, the contents of public works reports are worth preserving it is necessary that they be put in such shape as to invite their retention on book-shelves in private or public libraries. At least a portion of the number of reports issued should be bound in reasonably durable manner. When it is possible, volumes exceeding 600 pages should be avoided. Where the mass of material that must be presented makes larger volumes necessary, it had better be divided and issued in separate, smaller volumes.

Why Publish Technical Information?

The question may be raised by many, "Why should a public works report contain information other than that which interests the general public?" Why, for instance, should technical information, understood and available to only a comparatively few individuals, be prepared and printed at public expense? The answer to this criticism is that progress is constantly being made in municipal engineering work. Conditions change that require different methods of treatment, new processes are evolved and new materials come into use. Some of these methods and materials are more successful than others, and if the records of successes and failures were to be buried in the archives of the various departments, not only would such information, of utmost value to each city, be practically unavailable, but also the experience of all cities would be rendered useless to their neighbors. When the extremely small expense incurred in printing such information is compared with the inestimable value to be gained by every city's officials, there should be no hesistancy on the part of any city to publish in full its experience in all lines of public work.

The limits of this article will not permit a discussion of a detailed outline for each portion of a report on public works or the make-up of the tables to be presented, but enough has been said to indicate the main purpose around which the outline should be arranged and for which the report should be prepared.

The foregoing hints were given in an article in the Engineering Record by A. N. Johnson, of the Bureau of Municipal Research, New York City.

Elevator, boiler and flywheel accident statistics are regularly collected by the Fidelity & Casualty Co., of New York City. The figures for the United States and Canada for February and March, 1915, show 96 elevator accidents, only 13 of which were due to falling lifts. Only one person was killed and 14 injured by the falling elevators, while in the 83 shaft and door accidents 39 people were killed and 45 were injured. Practically all these last casualties could have been prevented by safety gates and interlocked shaft doors.

Wood Block Paving in the West

By S. B. Bennett[*]

THE use of wood blocks as a means of obtaining a permanent paving has been in vogue both in Europe and the United States for nearly a century, and has met with praise or with ridicule according to the results that have been obtained. In some cases wood block pavements have proved a great success; in others they have been condemned as most unsatisfactory. If careful inquiry is made into the real cause of the commendations or complaints, it will frequently be found that they have their origin in the suitability or otherwise of the materials and foundations obtained.

Some of the most important thoroughfares in European cities have been paved with wood blocks because such pavements have proved to be sanitary, silent, and able to carry heavy traffic.

Of recent years, owing to our highways having come to be used as a means of distributing heavy loads which previously were carried on permanent railway tracks, much more attention has been given to the materials and workmanship for road construction. The introduction of the steam wagon and heavy auto truck demands that even more care be exercised in this class of work.

Formerly wood blocks placed on a wooden base were thought to be satisfactory; little attention was given to the sub-grade or the foundation on which the wood pavement was to be laid, and any kind of soft wood was looked upon as a suitable material. Later on hard woods, such as the Jarrah and Karri of New Zealand and Australia, were put on the market, but it is owing to the introduction of creosote that wood blocks have come to be regarded as a first-class form of pavement. Creosote was used in very small quantities at first, but with further experiment and research it has been found that the wood blocks can be impregnated with large quantities of creosote, much to the advantage and lasting qualities of the pavement. If the temperature and pressure to which the blocks are subjected is not too great, they can be impregnated with creosote up to fifty or sixty pounds to a cubic foot. This amount, however, is considered excessive for paving blocks.

Preparing cushion for blocks.

During the summer of 1914 the Municipal Council of South Vancouver paved Main Street from 16th Avenue to 51st Avenue—a stretch of road two miles long and 54 feet wide—with wood blocks cut, prepared and laid by the Dominion Creosoting Company, a local firm with works situated on the banks of the Fraser River. The contract specified a 4-inch wood block saturated with 10 lbs. of creosote to the cubic foot, laid on a 6-inch concrete base, with a 1-inch cement and sand cushion between the concrete and the wood blocks, together with all necessary curbs, surface drains and catch basins. The pavement is guaranteed for fifteen years. This is looked upon as a great local achievement, for it has been made from B. C. fir, B. C. cement and B. C. creosote manufactured in a British Columbia factory, and dedicated to British Columbians of the present and future generations. It is one of the largest permanent pavement works undertaken in British Columbia, and two hundred and fifty men were employed on it for forty weeks.

Laying blocks between electric railway tracks.

The greatest difficulty was met with in the third section, from 34th to 45th Avenues, where the roadbed passes through what is generally accepted as an old beaver pond, swamp or muskeg. Various trial holes were put down in this section, and it was found that at a depth of from five to ten feet a solid foundation was obtainable. It was absolutely useless to think of putting a concrete bed on such a mass of soft earth, and consequently the whole of this bog earth had to be dug out. To carry out this work two steam shovels and forty teams were kept working steadily for several weeks. When the fill was completed and the roadbed had been well water-tamped and rolled the concrete, of 1:2:4 mix, was poured to a depth of six inches. When the concrete was set a sand cushion known as 3 to 1 mix was placed and sprinkled carefully, and on this the creosoted wood blocks were laid.

The roadway has been built by what is known as "lath construction." This leaves a space of from one-quarter to three-eighths of an inch between the blocks, which is then filled up with hot gravel, and while the gravel is hot a preparation of bitumen at a temperature of 300 degrees Fahrenheit is poured over the surface. After this mixture had percolated into the joints a further squeegee coat was poured over the blocks to fill up all the interstices. Next a thin coating of fine gravel was thrown over the surface and in a few hours the street was opened for traffic.

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[*] Municipal Engineer, South Vancouver, B. C.

Cement Testing

Throughout the whole of the contract samples were taken from each consignment brought on to the works, and the following tests were carried out:—(1) fineness; (2) specific gravity; (3) normal consistency; (4) time of set; (5) constancy of volume (normal and accelerated). The briquettes were all cured as nearly as possible under normal conditions in the laboratory, and the "personal equation," for all practical purposes, can be considered constant.

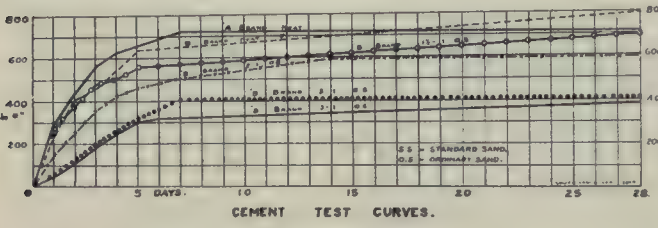
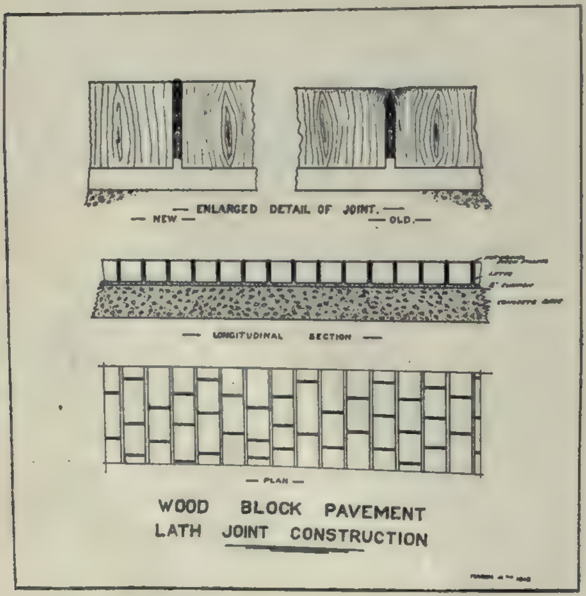


Diagram showing result of cement tests.

Apart from the tests of neat cement, and with standard sand (Ottawa Silica Company), tests were made of cement and the actual materials used on the works, as follows:—

Curb Mix.—3:1, 2:1, 1½:1, and cushion—3:1. Results are tabulated for comparison with that of standard Ottawa sand.

Tensile Strain.—The briquettes for these tests were cured uniformly in a moist chamber, and a Fairbanks testing machine was used. The averages tabulated show the result of a series of twenty-one tests for each reading for neat cement, and ten and five readings respectively for 3:1 and 1½:1 mixes.



Track construction with wood block paving.

Fineness.—The tests for fineness were averaged from 25 samples taken from bulk, with results as stated below:—

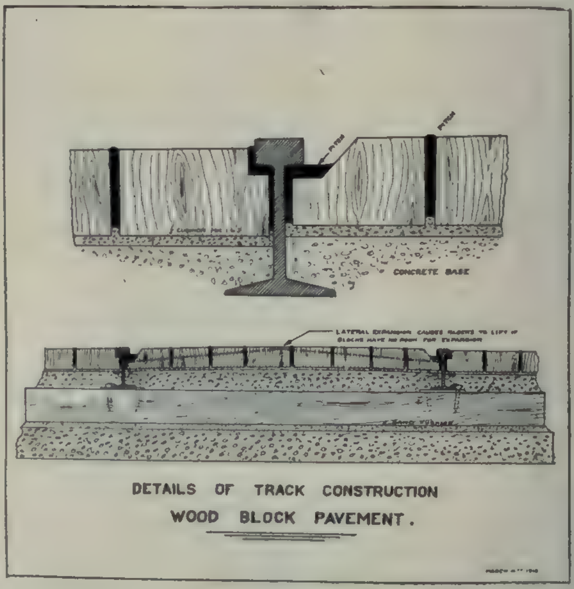
No. 100 Standard seive 2.1 per cent. residue.
No. 200 Standard seive 20.5 per cent. residue.

Tests of the above were made with 50-gramme samples, heated to 100 degrees Centigrade. The curve as illustrated is very interesting, showing the results of two different brands during a period of from one to twenty-eight days.

Wood Blocks

The wood blocks were rigidly inspected at the works during treatment, and notes were taken of the time under treatment, the contents of the charge and the amount of oil absorbed and the temperature and pressure maintained.

With respect to oil penetration, the standard can only be regarded as an average one on account of the wide difference in the density of the fir wood. It was found, however, on examination of the various exhibits, that the blocks after treatment showing an average penetration of from 1 to 1½ inches had shown at the end of sixty days a thorough penetration, and often a well-saturated block. Samples from bulk deliveries on the work from the commencement to the finish of the work were taken regularly and were tabulated carefully, and the results bear out the correctness of these remarks, and also help to prove the fallacy of assuming that, although a block delivered directly after treatment may show a penetration of even less than an inch, it is of necessity a poor block.



Details of paving.

The mode of lath construction of wood block pavement is shown in detail in the diagram herewith. The lath joint gives plenty of room for expansion, besides binding the blocks together, as the mortar joins the bricks together in the building of a wall.

Track Construction.—The class of paving to adopt between the rails in any track construction is one of the most debatable subjects in the design of good roads. As will be seen from the drawing, special gauge blocks were used, and over the fish plates long blocks of specially hard wood were used, the blocks being slightly longer than the fish plates and purposely drilled and bevelled for receiving the nuts which jointed the rails. This was considered one of the special features on this class of work as carried out in South Vancouver.

Pumps for City Water-Works[*]

By J. E. Craig[†]

THE selection of pumping machinery for modern plants has afforded the opportunity for the making of many mistakes in judging the real value of the equipment adopted. City authorities are apt to consider that they can determine the value of a pump as well as an engineer, and ignore his recommendations, while often enough the engineer designing water-works plants has not judged aright of the worth of pumping equipment for peculiar conditions.

For pumping service in villages and small towns where the regular domestic supply is from an elevated tank the demand is for a pump to fill the tank at intervals and to furnish direct pressure for fire-fighting purposes. If there is available a reliable source of cheap electric power, motor-driven turbine pumps or triplex plunger pumps are desirable—the latter driven through gears by electric motors. If such electric power is not available, triplex plunger pumps driven by gasoline or kerosene engines should be given careful consideration. These machines are highly desirable for intermittent service, as they deliver their full output at once when started, instead of requiring such time as is necessary to raise steam in a boiler for a steam-driven pump. In addition to the great loss of heat from the boiler while the pump is not in actual operation, the inefficiency of all small direct acting steam pumps almost eliminates this type, except when operated in connection with an electric lighting system which requires that steam be kept up most of the time, at any rate.

In considering the service for towns which use from 1,000,000 gals. to 5,000,000 gals. a day there is a broader field for careful consideration as to the actual conditions to be met. When the supply is taken from a river and first delivered to filter beds there is nothing better than the turbine pump for this service, as a low and practically constant head is to be operated against. The turbine pump may be driven either by an electric motor or steam engine, as the local conditions demand. Where the source of supply is wells in which the water does not rise to the surface the engineer may consider several methods. One is the direct acting deep well pump with the steam cylinder at the surface and the water piston near the elevation of the source of water, actuated through a long vertical piston rod. One of the best examples of this system is at Memphis, Tenn. The Memphis supply is interesting because such a large city is supplied from a great many wells scattered for a considerable distance and flowing into a masonry tunnel which is nearly 100 ft. below the surface of the ground and which discharges by gravity into a sump at the pumping station. The steam cylinders of the vertical pumping engines are in the engine room at the surface of the ground, while the water cylinders are far below near the surface of the water. These engines have given excellent service.

Small pumps of the usual deep well type are liable to give considerable trouble with the water piston and valves far below the surface of the floor and where they cannot be inspected, as the ordinary deep well pump has its piston rod and water cylinder in a well usually less than 1 ft. in diameter. The pumps at Memphis are in a sump large enough to give ample access even at the bottom for attention and repairs to the water cylinders.

In some parts of the country where the source of ground water is not more than 30 or 40 feet below the surface the ordinary duplex steam pressure pumps are put in a sump, far enough below the surface so that water can be drawn from the natural source with a suction lift of not more than 15 ft. This arrangement, which subjects the pumps to possible submergence if the level of the ground water should rise, and from the usual dampness and inaccessibility of such places, is in small favor. In the rice fields of Louisiana and Texas a submerged vertical turbine pump in the bottom of the well, driven through a vertical shaft either with a belt or electric motor, has found considerable favor.

For a reliable method of raising water from a considerable depth probably there is nothing better than compressed air. The air lift leaves much to be desired in the matter of total efficiency, but its reliability of operation and durability offset this objection. The entire engine is in the pumping station. One compressor can raise water from one well or many, and they may be scattered widely. When the available funds will provide a compressor with Corliss valve, steam cylinders, and condensors, and two stage compression, if the required pressure warrants this, very satisfactory operating efficiency is obtained.

In the choice of pumping engines for the smaller cities, which require between 1,000,000 and 5,000,000 gallons daily, there is a slightly wider range of equipment from which to make a choice to meet the conditions of the individual installation. In this class of pumping station 24-hour attention is usual. Most such cities operate an electric lighting system in connection with the pumping station, which requires that boilers be kept in operation constantly. Under this condition the choice lies between several arrangements with steam as the motive power. When the engine operating the generators are of high efficiency, ample capacity, and in duplicate, electric motor-driven pumps give excellent total efficiency. The higher steam efficiency obtainable from the steam engine often more than balances the loss in electrical equipment. Either turbine pumps, direct connected to electric motors, or triplex plunger pumps, motor-driven through gears, are available.

It is usually demanded of pumping engines that they deliver the normal domestic consumption, against about 50 lbs. to the square inch, for more than 95 per cent. of the time in operation, and yet be capable of furnishing this same output and considerably more for fire streams, at 125 lbs. to the square inch, or more. This condition means the engine must operate 95 per cent. of the time, at about 40 per cent. load, or at times of fire at more than 100 per cent. over-load, depending on whether the engine is designed for its rated service at domestic or at fire pressure. To meet these requirements two turbine pumps can be operated in series for fire pressure and either operated singly for domestic service.

To have duplicate equipment, either set of which is capable of meeting any reasonable daily demand for both domestic and fire service, is absolutely essential for a first-class water-works pumping station. To meet this condition will require much idle equipment, or operation at small load factor, with turbine pumps. Triplex plunger pumps, motor-driven, give good efficiency under domestic service pressure, and will deliver the same volume at double the pressure when required. They are reliable and worthy of careful consideration in this connection. For service of this character duplex direct acting, tandem compound, or triple expansion, condensing pumping engines are probably the most used. Under favorable operating conditions a duty of 70,000,000 ft.-lbs. per 1,000 lbs. of steam may be approached. In the smaller stations of this class one more expensive compound engine may be installed, which will do most of the work with reasonable efficiency, and one Standard Underwriters' Steam Fire Pump, which will serve to aid in giving fire service, and can furnish domestic supply also when the more efficient engine must be stopped for repairs.

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[*] From The Cornell Civil Engineer.

[†] Engineer of the Board of Port Commissioners, Jacksonville, Fla.

In many of the stations delivering 5,000,000 gals. a day or more vast sums of money are wasted, either through the operation of equipment unsuited to the conditions, or equipment that would be inefficient under any conditions. Here it becomes possible to make interesting comparisons between present and final economy. Large pumping engines may be obtained that will give a very high operating efficiency. Some in daily operation are giving a duty of about 200,000,000 ft.-lbs. per 1,000 lbs. of steam. These engines, of course, represent considerable capital, and the problem before the engineers is to determine how large an investment the proposition will warrant. It is possible to purchase costly, high-duty engines and operate them under such conditions that the interest on the first cost of the engine is more than the saving effected by their higher efficiency in operation.

For the smaller stations in this class the horizontal cross compound crank and fly-wheel type of condensing engine offers a satisfactory total efficiency; its first cost is much less than the vertical triple expansion, crank and fly-wheel type, and a duty of 125,000,000 to 150,000,000 ft.-lbs. can be obtained.

In the larger stations, using only engines of a daily capacity of 12,000,000 gals. or more, every factor should be considered before any but the vertical triple expansion type of engine is chosen, if the necessary money can be secured to install the more costly type. Data should be obtained as to the actual daily probable output during the term of service of the engine and the cost and efficiency of the two general types of machines. In the larger pumping stations, when the city also owns its electric lighting system, there is a possibility of securing considerable saving in the joint operation of the two stations by having a turbine pump designed to deliver at best efficiency the average domestic consumption so that it will be running practically constantly; this pump to be driven by a synchronous motor so designed and operated as to improve the power factor on the electric circuit.

Foreign Development of Floating Concrete Caissons[*]

By Harrison S. Taft, assisted by O. D. Jones

APPARENTLY, in overlooking the opportunity and advantages to be derived in using floating concrete caissons in port and other subaqueous work, the harbor development engineers of this continent have perhaps been neglecting a type of structure that has been widely and successfully used by foreign port engineers since 1905. It is possible that the small amount of attention which has been given to an extensive development of our shipping ports during past years has not called for any special treatment of the subject. It is also possible that past failures in the use of cement under salt water conditions have prejudiced conservative concrete engineers against the use of such a material when in contact with sea water. Then, again, certain legal considerations may have operated against the development of floating concrete caissons in hydraulic engineering in this country.

Whatever have been the real reasons for the antipathy of the American engineer toward taking up the development of floating concrete caissons, in view of the vast sums that are now being spent in making our harbors and shipping facilities equal to the most modern of foreign ports it would seem that such a type of structure might be made to play an important part in such work. Not only can they be built in the dry and thus become thoroughly cured before coming into contact with the sea water (a most essential feature in the use of cement subjected to salt water action), but their economy over old time methods of such uses of concrete is marked.

In order to learn of the real value and worth of such a type of structure in future development of our ports it is perhaps fitting to review what other nations have been doing in the use of floating concrete structures, especial emphasis being placed upon floating concrete caissons in this discussion. While such a review may not determine the origin of the art, it does seem apparent that the actual practice of using floating concrete caissons has been carried out simultaneously in Europe and America. Though United States patent papers covering "Reinforced Concrete Caissons for Use in Hydraulics" were granted to Col. W. V. Judson, Corps of Engineers, U. S. Army, in 1901 and 1909, the records of foreign technical papers, etc., indicate that a number of years before Colonel Judson made a practical application of his idea floating iron caissons, constructed partly of concrete, were used by foreign engineers in the construction of their breakwaters and other subaqueous structures, thus perhaps opening up the question as to who was the real originator of such a mode of construction, the use of reinforced concrete having been but a detail improvement over and above the type hitherto used.

Floating Iron Caissons

Since the idea of using floating concrete caissons seems to have been a step in advance from the use of iron caissons, it is fitting to make note of a few undertakings with such a type of structure, especially those structures which it has been plainly stated led to the adoption of full concrete structures in the subsequent undertakings. For, as will be soon noted, the successful use of floating iron caissons in the construction of the west jetty at Port of Bilbao, Spain, during 1895-1902 led to the adoption of full concrete caissons in the construction of a breakwater and sea-wall at Barcelona, Spain, in 1905.

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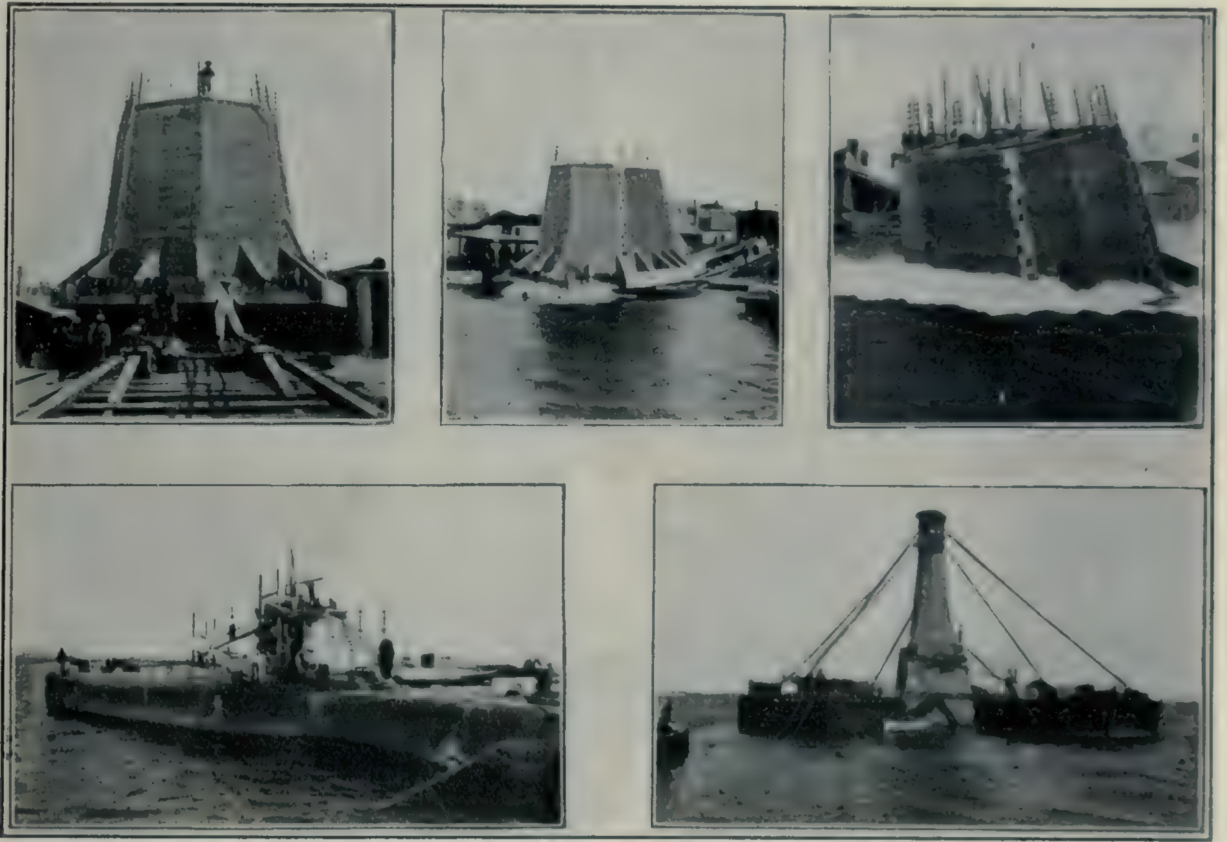
[*] Part of an article printed in the March-April issue of Professional Memoirs, Washington, D.C., to which paper we are indebted for permission to reprint the article and for the loan of the illustrations. The part of the article covering the use of concrete caissons in America appeared in our issue of June 30.

The first of the iron caissons used at Bilbao was constructed in 1895, the successful results obtained with this pioneer structure resulting in the same system being used throughout the entire work. Each of these caissons was approximately 42½ feet long, 23 feet wide, and 23 feet high. After being built on the shores of the port they were put afloat and ballasted with concrete to a depth of 5 feet from the bottom. They were then towed to and sunk into position upon a rubble foundation by means of water ballast. Twelve premoulded concrete blocks, each about 13 by 9 by 8 feet, containing 40 cubic yards of concrete (equal to about 80 tons), were immediately placed in each caisson in order to obtain sufficient stability against wave action in the shortest space of time—a much quicker operation than if concrete had been used. The voids between the sides of the iron caissons and the blocks were then filled with grout. On top of the substructure thus prepared was built a superstructure in the form of a sea-wall. The time of placing and filling a caisson was about thirty-one hours. This undertaking appears to have been the pioneer in the use of such a mode of construction.



Lighthouse caisson and tower, Alexandria, Egypt, showing (1) Caisson on slip; (2 and 3) Launching, first and second stages; (4) Completion of superstructure; (5) Steadying of floating caisson between two lighters, front view.

At a still later date (previous to 1900) the same mode of construction was used at Zeebrugge in the North Sea, with the exception that the iron caissons rested directly upon the bottom of the sea, and not on a rubble fill. The iron caissons in this undertaking were 82 feet long, 29½ feet wide, 28½ feet high, and weighed about 4,500 tons when filled with concrete. The caissons consisted of an iron frame built of angles and tie members, the whole covered with a steel plate so as to form a concrete form, as it were, of the proper shape, the concrete being poured into the form thus built, the metal form becoming a part of the permanent structure. The thickness of the sides of the complete structure was 3 feet at the base and 1 foot at the top. The caissons were floated to position and sunk, and then filled with concrete.

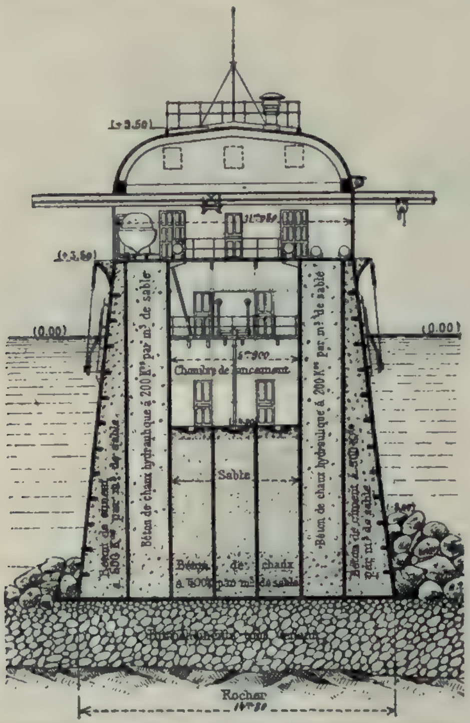
Though the authors found reference to "The launching of concrete and masonry blocks in repairing jetties in 1901," they were unable to obtain detail information concerning the work. From the title it would appear that some type of floating concrete caisson might have been used. Still, from the few cases cited, it is self-evident that floating concrete caissons were, as already stated, simply a step in advance of floating iron concrete caissons—a step that would follow naturally with a wider development of the uses of concrete.

Though at first the difficulties of launching a concrete structure void of any reinforcement would seem insurmountable, it appears (as will be noted further on) that the uncertainty in respect to the floating capacity of a cellular concrete structure of large size was the prime factor that delayed the use of floating concrete caissons in hydraulic engineering, the launching problem having been solved by the conception, by English engineers, of a lifting-depositing dock.

Spain

Barcelona.—While the conception of using floating reinforced concrete caissons in hydraulic engineering may have originated in America, the first practical use of such a mode of construction seems to have been made in a foreign country—namely, Spain.

As stated by Don Julio Valdes y Hamaran at the International Congress of Navigation held at Milan in 1905, the design adopted for the Barcelona (Spain) breakwater was "derived from the type so successfully used at Port of Bilbao" (Spain). A riprap substructure was first constructed and 80 tons of concrete blocks thrown in at random, "raising the substructure on the outside from about 30 feet below to about 6½ feet above sea level." On the inside was built a wall "composed of monolithic concrete caissons, forming the last word in this sort of work." The space between the concrete caissons and the pell-mell concrete blocks was filled with riprap of large stones, a double tier of concrete guard blocks being set on top of the fill. The quay and shelter wall of the breakwater rest on the monolith caissons. The plans for this structure were approved of in 1903, and the work begun soon afterwards, being in full swing during 1905. From the above it appears that the first use of floating concrete caissons was on the part of Spanish engineers.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Chambre de lancement
Sable
Béton de chaux hydraulique à 200 K par m³ de sable
Béton de ciment à 500 K par m³ de sable
Béton de chaux à 300 K par m³ de sable
Rocher
14m80

Transverse section through torpedo testing station near Toulon, France.

As noted in the Proceedings of the International Congress of Navigation, held at St. Petersburgh in 1908, the floating concrete caissons used in Barcelona in 1905 were "not made of armored concrete." They were made "without any kind of strength at their base, in the long walls, or in the intermediate bulkheads, thus avoiding decomposition of the armored concrete and obtaining a maximum economy in first cost by not resorting to expensive material." The caissons were about 46 feet long, 20 feet wide, and 23 feet high. The cement used was "Grippe Cement from Teil." The bottoms of the caissons were made of practically a 1:2:4 mixture, and the walls of a 1:1½:3 mixture. The walls were also given a coating of 1:1½ mortar in order to increase their water-tightness.

From information available it seems that the caissons used at Barcelona were built on a sort of building stage and then put afloat by means of the lifting-depositing dock, spoken of above, and as will be further described in discussing the work at Kobe, Japan. The caissons were given one month of curing before being put afloat, and then moored in the harbor for various periods in smooth water, awaiting a favorable opportunity to set, though no doubt some were set immediately after launching. The time required to manufacture one caisson has been stated to have been eighty-four hours—and the time of towing to their final resting place and the sinking thereupon about three hours. The method used in sinking was by water ballast admitted through valves in the sides of the caissons. It appears that in some cases large sized concrete blocks were used to fill the settled caissons, as in the case of the Bilbao work already spoken of; at other times large sized stones were used, the water pumped out, and a grout fill pumped in to fill the voids.

As is usual in pioneer work, it is perfectly plausible to imagine a variety of schemes having been used in the work, each an improvement upon the other, and all leading to a successful conclusion of the entire undertaking, detailed information upon which is perhaps not readily obtained by the American engineers.

Although the caissons employed in the pioneer usage were of a somewhat small size compared to similar structures used now-a-days, this fact was recognized, for, as Don Hamaran stated in 1905, " . . . . . it is believed that the system would be perfectly applicable with larger dimensions. Furthermore, the net cost per unit would be less, as the use of cement and the cost of transportation of the blocks, which are inversely proportional to the volume of the latter, would be reduced."

Holland

Rotterdam.—The most extensive use of reinforced concrete caissons in harbor development work appears to have been made by the Hollanders, who perhaps are, from necessity, the most famous hydraulic engineers in the world. The first use made by them of such a type of structure was in 1905, in the re-building of a river-wall at Rotterdam that had become badly damaged. In fact, the original wall had for some unknown reasons split in two and been shoved out of line for a distance of some 675 feet—even to the extent of some 5 feet at one point in the wall.

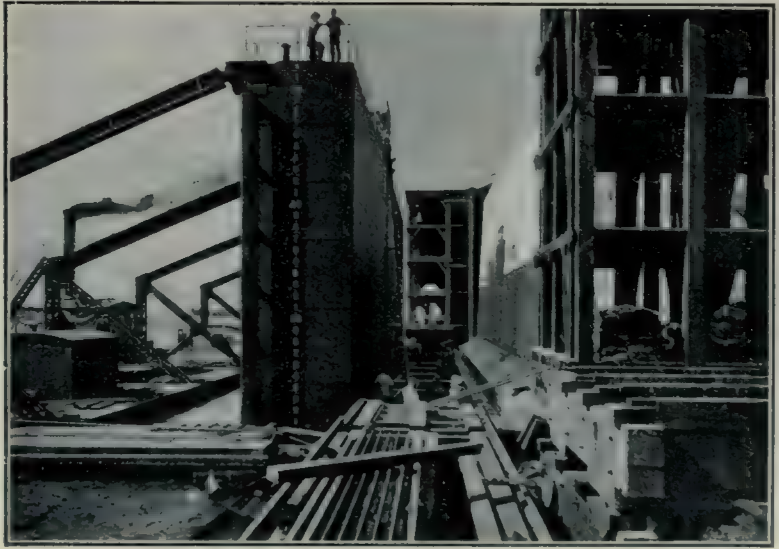
In making the repairs rows of piles were first driven along the face of the old wall and capped with heavy timbers below the water-line. Six reinforced concrete caissons were constructed in a dry dock, given three weeks of curing, and then put afloat like a big barge. After being kept afloat for about two months, the caissons were towed a distance of some three miles to the location of the damaged wall. After being properly located they were sunk to position upon the prepared piling foundation in such a way that two-thirds of the caisson rested upon the base of the old wall and one-third upon the wood piling. The caissons were then built up to the height of the old wall.

The first one of these caissons was about 75 feet long, 18 feet wide, and 4½ feet deep, with partitions about 6 feet apart, thus making a cellular structure of it. The success obtained with this first attempt was marked, and justified the engineers in using the same method of procedure in repairing the rest of the wall, the other five caissons being 120 feet long and 30 feet wide. These caissons were of a 1:2:2 mixture with the outside surface coated with tar.

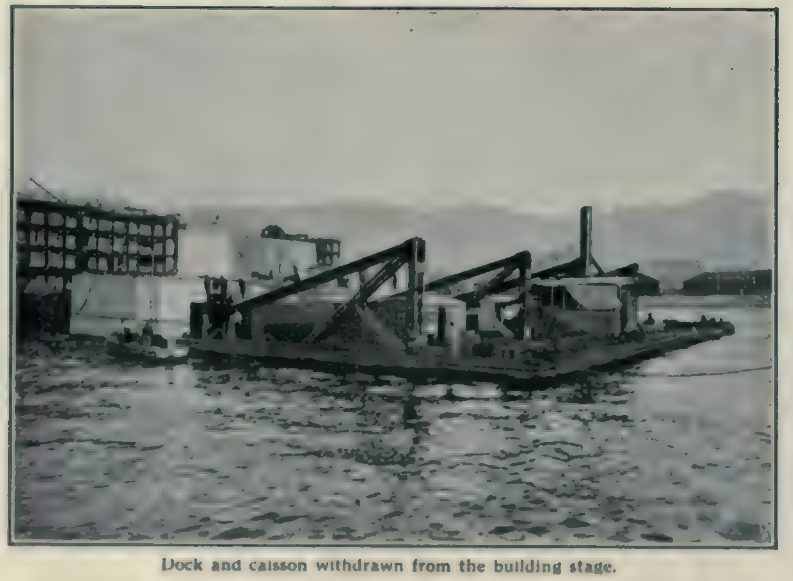
The unqualified success attending the use of floating concrete caissons in making these repairs led the engineers of Rotterdam to build full depth caissons which would rest directly upon the sandy soil without

Building Caissons for the Kobe Harbor Improvements, Japan

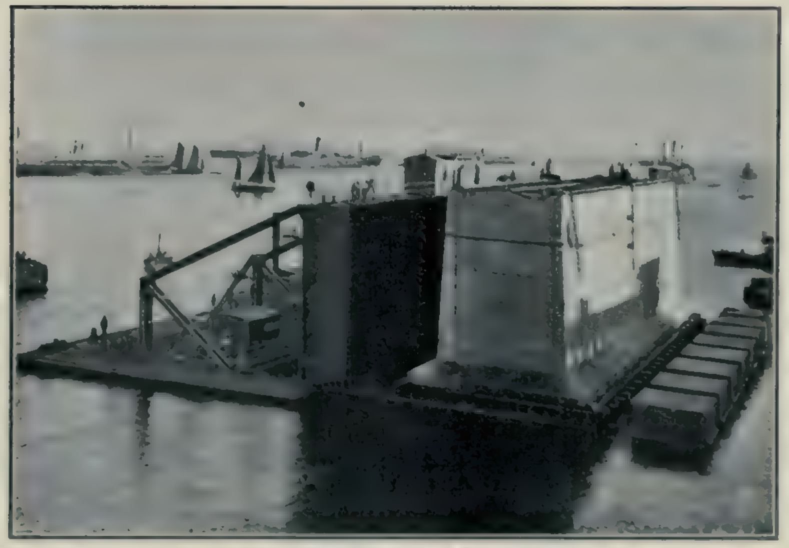
Caisson afloat, towed by a tug.



Depositing dock with its pontoons inserted beneath caisson.



Dock and caisson withdrawn from the building stage.



Dock carrying a caisson on its pontoons.

any sub-piling, a type of structure that has become the standard practice for their river walls.

In undertaking the construction of six full depth caissons in building some 615 feet of wall in 1906 the engineers first experimented with two such structures, building them simultaneously, each being 30 feet high. In order to obtain proper stability it was necessary to place ballast in the two caissons before launching. Since the floating draught was more than the depth of water over the dock's sill, it was necessary to use pontoons in floating the concrete caissons.

After being put afloat the caissons were towed to their final resting place in the wall and sunk on to the prepared sandy bottom. The experience with these two caissons led the engineers to consider the feasibility of building the caissons only to such a depth as to guarantee floating stability when first put afloat, their up-building to take place afterwards. These two caissons also led to a more satisfactory design for the following caissons, and proved conclusively that large concrete structures of a cellular construction could be kept afloat for a long time.

The four remaining caissons in this second wall were designed for a length of 120 feet, a depth of 30 feet, and a width of 21 feet, the walls being built with a batter. The main body of these caissons rested upon a heavy concrete slab, built monolithic with it, 29 feet wide, thus forming a shelf, as it were, some 4 feet wide on each side, beyond the sides of the main body of the structure. The ends of each caisson were so built as to form a dovetail joint with its neighbor. The caissons were divided into twenty compartments by means of nine athwart partitions and one longitudinal one.

In constructing these four caissons a pit was dug in the river bank, covered with 9 feet of sand, and a platform made by driving wooden piling into the fill. The caissons were first built to the height of some 17½ feet and then put afloat, having a draught of about 11 feet, with a freeboard of about 6 feet. They were then built up to at total height of 30 feet, corresponding to a draught of 22.5 feet, ballast being inserted to provide the necessary stability. The caissons were then towed to their proper place in the wall and sunk into position upon the prepared bottoms by means of water ballast, the entire work being carried out with great success.

After the sinking operations had been completed, the cells of the caisson were filled with concrete and sand, concrete being used for the front row of cells and sand for the back row. If the front row of compartments had been filled with sand there would have been a danger that it might in some way work out of the said compartments and thus destroy the stability of the whole wall against sliding. As the concrete fill was placed in the dry, the outer walls of the caisson, as well as every other cross wall, had to be designed for a pressure head of 33 feet.

Since the caisson had but 1½ feet of freeboard above low water when sunk into position, and the water rose to 3½ feet above them at high water, it became necessary to place an iron deck over four adjoining compartments—made water-tight by hemp packing—the decking being provided with four hatchways, one to each compartment. The four compartments were then pumped out in such an order and at such a rate as not to create too great a difference in water level, and thereby avoided any excess pressure upon the interior partitions. The two front compartments were then filled with concrete at the same time —the two rear compartments being filled with water to preserve an equal pressure on each side of the longitudinal bulkhead. After the concrete had been completed the two rear compartments were filled with sand dumped into the water in the compartment. The main wharf wall was then erected on top of the completed caisson.

The third attempt with floating concrete caissons at Rotterdam followed soon after the completion of the above six full-depth caissons, the same mode of construction being used as in the preceding case. The wall in this third undertaking was 4,800 feet long. Since it was possible to have under actual process of construction four full-depth caissons at the same time that four other caissons were in the process of setting in the wall, each caisson being 120 feet long, 960 feet of the wall was in the making at one time—a rate not possible with the ordinary modes of building walls.

A still later use of concrete caissons at Rotterdam was shown in 1911, in a further extension of the river-walls. In this case the type and mode of construction used in the building of the 4,800-foot wall was adopted, the caissons being 134 feet 6 inches long, 32 feet 9 inches wide, with a base of 31 feet 10 inches.

Since the Rotterdam engineers have standardized the type of their caissons, it is reasonable to suppose that all future river-wall work done at Rotterdam will be similar to the above described methods, and that said method can be adopted with a guarantee of success by other engineers.

Denmark

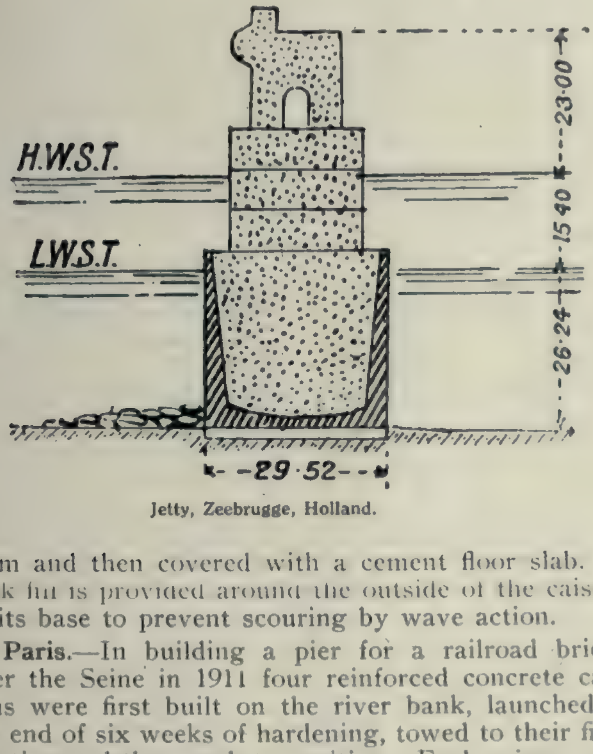
Norre-Sundby.—At this harbor in Denmark floating concrete caissons had to be resorted to in the construction of a dock 725 feet long, on account of the poor soil and the teredo. The methods used were similar to the methods used at Rotterdam, with the exception of the size of the caissons. The Denmark caissons were 32 feet 9½ inches long, 25 feet high, and contained five compartments, there being four athwart partitions and no longitudinal ones. The fill material was of sand. A concrete wall was built along the upper half of the caisson above low water level.

France

Toulon.—The first attempt with floating caissons on the part of the French engineers seems to have been in connection with the construction of a torpedo testing station near Toulon, France, in 1909. The caisson was of a truncated pyramid shape, was built in a dry-dock, put afloat, and towed to and sunk in its final position. The base of the truncated structure itself was 77 feet long by 48½ feet wide. The platform slab upon which the main structure rests was 77 feet long but 55 feet wide, thus forming a shelf outside the truncated structure of some 3¼ feet along each side. The height of the truncated structure is 51 feet, 11½ feet of which is above the water level, the remaining 39½ feet being submerged. The sides and ends have a tumble-home with a flared-out shelf at their top so as to cause the waves to return on themselves. Thus the top of the structure is but 70 feet long and 36½ feet wide.

The caisson is divided into seventy-seven compartments by means of ten athwart and six longitudinal concrete partition walls, the compartments being filled with a lean concrete and sand ballast to weigh the caisson down. The bottom slab, the outside walls, and the interior partitions are but 6 inches thick, properly reinforced. The base slab is built with a camber of 2 inches transversely. On the top of the caisson is located a superstructure of a design suitable for the purposes of its special uses.

In building the caisson a dry dock was made use of. First the 6-inch slab was poured, then the exterior and interior walls were brought up, the former to their full heights, the latter for a height of but 10 feet. After the caisson had been put afloat, the interior walls were brought up to a height of 37½ feet. A concrete fill was also put in the lower part of each compartment to a depth of 6½ feet, giving a draught of 26½ feet, corresponding to a displacement of 2,800 tons. After being properly protected and internally braced the structure was towed some 22 miles to its final resting place at a speed of about 1½ miles an hour without any difficulty. The caisson was sunk by water ballast to its final resting place on a prepared bottom. The different compartments were then one by one pumped out and filled with a suitable concrete fill. The fill in the compartments next to the shell was of a lean cement concrete carried their entire depth. The next set of compartments had a lean lime concrete fill, also carried their full depth. The interior compartments were filled with sand to the level of the working platform and then covered with a cement floor slab. A rock fill is provided around the outside of the caisson at its base to prevent scouring by wave action.



Jetty, Zeebrugge, Holland.

Paris.—In building a pier for a railroad bridge over the Seine in 1911 four reinforced concrete caissons were first built on the river bank, launched at the end of six weeks of hardening, towed to their final location and then sunk to position. Each caisson was 34½ feet long, 14½ feet wide, and 14 feet high, well reinforced in each direction. The upstream ends were rounded. The walls were 6 inches thick at the bottom, tapering to 5 inches thick at the top. The caissons were built with a temporary wooden base which could be knocked out when the caissons were in their final position for sinking. After being sunk the interior of each caisson was filled with concrete, the fill resting upon 12-inch diameter concrete piles.

Havre.—In constructing the West Dike at Havre floating concrete caissons were built on land, set afloat, towed to and sunk into position on top of a rock embankment built above the bottom of the harbor. The length of the dike was 4,740 feet. Each caisson was 82 feet long, 19.68 feet wide, and 18.86 feet high. The lower third of the caisson had vertical walls, the upper two-thirds being built with a tumble-home so that the width of the caisson on top was about 11 feet. A longitudinal bulkhead, located 6 feet from the face wall and having the same general shape as the outside walls, divided the caisson into two compartments. After being sunk into position the outer compartment was filled with concrete, and the inner compartment with earth. On top of the caisson a regular sea-wall was constructed of brick work.

Egypt

Alexandria.—During the first half of 1911 a concrete lighthouse was constructed on the shore of Alexandria Harbor, Egypt, in the form of a reinforced concrete caisson, and floated out to its final position some four miles from its place of construction. The base of the structure consisted of a seven-sided slab, 8 inches thick, reinforced with one 12 by 24-inch longitudinal beam and five 8 by 16-inch transverse beams. The axial dimensions of the base were 37 feet by 41 feet. On top of the slab a hollow tower some 45 feet high, having tumbled-home sides and of the same general shape as the base, was erected. The shell or sides of the base tower were 6 inches thick, being strengthened by 8 by 12-inch vertical webs and 6 by 6-inch horizontal ribs. At the centre of the tower was located a 12 by 12-inch column with 8 by 8-inch struts extending out to the sides. Since the base of the tower was set in from the edge of the horizontal base, making a shelf, as it were, 5 feet wide, it was necessary to provide a series of brackets on the outside of the tower itself at its intersection with the base, and also to construct a rim or beam all round the outer edge of the horizontal base. A lantern tower, 36 feet high, was constructed on top of the base tower. This lantern tower was 12.3 feet in diameter at its base and 8.2 at its top, being well braced by 6 by 6-inch and 8 by 8-inch bracing struts and beams. The thickness of its sides was 4 inches.

The whole structure weighed about 1,700 tons, with a displacement of some 600 tons, resulting in a load of 1,100 tons on the sands. A 1:2:4 concrete with no waterproofing material was used.

In building this structure the flat base and 24 feet of the caisson tower were first constructed on land and then launched. The caisson was then built up to its full height while the structure stood alongside of a wharf. The lantern structure was also cast on shore, placed on top of the lower structure and made secure thereto.

The whole structure was lashed between two seagoing barges, with the tops of the upper and lower towers well guyed to the outer gunwale of the barges. An attempt was then made to tow the entire structure to its place of final location. When about half way on its journey the upper tower broke loose and fell over on to one of the barges without injuring the tower to any great extent. More damage is said to have been done to the caisson by the fall than to the tower, the latter being set upon shore as a land beacon. When the caisson finally reached its place of depositing it was sunk on to the prepared bottom by filling with water. The inside was then filled with concrete placed in the wet to such a height as to preserve the stability of the structure when pumped out. After the caisson had been unwatered the rest of the interior concrete was placed. The lantern tower was then built in place, and the structure as a whole completed. Though the tower was in heavy collision with a 4,000-ton steamer, it was not damaged, nor was its light put out at the

Torpedo station near Toulon, France. Towing caisson to its final site.

time of the collision, thus going to show what an amount of lateral pounding concrete will stand when properly made.

Italy

Genoa.—In the construction of a set of piers at Genoa, Italy, it was necessary to make use of floating concrete caissons in the construction of two of the said piers. Each caisson was 17 feet 3 inches by 13 feet 11 inches, and 36 feet high. The lower part was built with a cutting edge and a working chamber 6 feet high. The concrete walls were strengthened by two vertical webs on each side of the caisson with a series of struts across the interior from web to web. After being put afloat and towed to their final resting place in the harbor they were sunk into the mud by excavation in the air.

Russia

Whereas the Russian engineers seem to have made considerable study of the application of floating caissons to harbor development work, the authors have but one record of the actual use of such a type of structure on the part of the said engineers. Still, it is of interest to note in passing that in Russia as well as at Valparaiso and Stolpmunde, bottomless concrete caissons "set by means of metallic pontoons applied to the sides of the caissons" have been used. But such types of structures are foreign to the subject of this paper, and so will not be dwelt upon.

Tuapse.—The only record that the authors have of the actual use of floating concrete caissons on the part of the Russians is in connection with the construction of a jetty at Tuapse on the Black Sea. The length of the caisson was 56 feet, the width 21 feet, with heights of 6, 12, 9 and 22 feet, respectively. The weight of the largest caisson when empty was about 268 tons; when filled, about 1,600 tons. They were divided longitudinally by two partitions, the outer compartments being filled with a lean concrete, and the inner compartments with the same material less the cement. The caissons rest upon a riprap base, and so form the vertical part of the breakwater or jetty.

Japan

Kobe.—The most extensive use that has apparently been made of floating concrete caissons outside of Rotterdam is at Kobe, Japan, where large harbor improvements are under way at the present date. In the construction of four new concrete piers, reinforced concrete caissons—some 119 feet long, 35 to 40 feet wide, and 24 to 30 feet high, divided into twenty open-top cells by interior partitions, and weighing from 1,900 to 2,400 tons each—are being built in the dry on a pile structure on the shores of the harbor. After sufficient curing the caissons are lifted off their pile foundation by a specially designed depositing floating dock, carried into deep water, and put afloat by sinking the depositing dock and withdrawing it from underneath the concrete caisson. The caissons are then towed to and sunk in their proper places in the quay wall. When afloat the caissons drew about 25 feet. The exterior walls of the caissons are on the average a little over 1 foot thick, being built with a taper. The interior walls are of two different thicknesses, alternately 8 inches and 11 inches.

The land foundation upon which the caissons are built consists of seven groups of piling 15 feet apart, there being three rows of twelve piles in each group. The piling is properly capped with heavy timber running athwart the caisson, so as to permit the fingers of the lifting dock to be inserted under the caissons between each group of piling. The cost of the lifting dock was about $27,600. It takes two hours to put the caisson afloat.

Three building stages are used in the Kobe work, with an output of twelve caissons a year; three months being required to mold, mature, and put afloat each caisson. For building the seventy-nine caissons seven years will be needed. If the caissons had been built on a floating dry dock it is estimated that twenty years would have been needed to finish the work, or the use of five such docks for a period of seven years. Thus, while the lifting dock is used but at intervals, it is a far cheaper mode of construction than any other possible method.

The original conception of a "lifting-depositing dock" is due to John Standfield, of England, who has taken out English patents upon this type of structure. Whereas the idea at first did not find much favor, the principal reason, and the only one, as it appears, against such a mode of operation, was the doubt as to the possibility of building a concrete caisson that would have floating capacity. As above stated, the first application made of the idea of a "lifting-depositing dock" was at Barcelona, where the port engineer used the device "for picking off the depositing stages the ferro-concrete blocks which formed the extent of the harbor of Barcelona." From the success obtained at Kobe it would appear that the system of construction used by them is one worthy of deep consideration on the part of all harbor engineers.

New Methods of Odor Elimination at Garbage Plants

OFFENSIVE odors from New York City's garbage and dead animal disposal plants on Barren Island are to be eliminated by measures proposed by Irwin S. Osborn, of Toronto, and embodied in a report to the Board of Estimate and Apportionment, according to the Engineering Record. A number of changes in design and in operating methods are suggested, and a radical departure from present practice is advocated for treating the insoluble gases from the digester tanks of the reduction plant. These gases, after passing through condensers, have been discharged into the boiler furnaces and passed thence to the stack. Mr. Osborn's investigations, which are claimed to be the most complete of their kind ever undertaken, show that this heat treatment, instead of acting as a deodorizer, actually makes the gases more offensive. It does, however, render them soluble, so that the final process of treatment should be washing. Special attention also should be given, according to the report, to keeping all garbage digester tanks free from leaks, and to the installation and operation of condensers with an adequate water supply.

There are three so-called disposal plants at Barren Island, all privately operated, but under the general supervision of the Department of Street Cleaning. The largest is the garbage reduction plant of the New York Disposal Corporation. A fertilizer plant, where garbage tankage is dried, is operated by the Thomas F. White Company, and at a rendering plant dead animals are treated by the Products Manufacturing Company.

Garbage is delivered at the plant of the New York Disposal Corporation, the largest of its kind in the world, by scows, from which it is unloaded by grab buckets and discharged into scraper conveyors. Connecting the conveyors with digesters are swivel spouts which discharge the garbage directly into the digester tanks. The digesters are housed in two buildings, known as the New York building and the Brooklyn building. The New York digester building contains 68 digesters and the Brooklyn building 104 digesters. The digesters are approximately 6 ft. in diameter and 18 ft. long, constructed with a cone bottom, which is connected to a receiving tank by a large gate-valve and nozzle on the bottom of each digester. The garbage when cooked is discharged into the receiving tank, from which it is passed through a roller press, steam press, or hydraulic press, for extracting free water and grease.

Operation of Digesters

The digesters when filled are sealed by tightly closing the charging hole at the top, after which live steam is admitted at the bottom. The steam, entering the bottom, circulates up through the mass submerging it at from 60 to 80 lbs. pressure. After application of the steam from 6 to 10 hours, the garbage cells are broken down and the material thoroughly sterilized and digested. The top of each digester has a 2-in. vent line for relieving the pressure on the digester after the material has been digested. The 2-in. vent line is closed off by a valve during the cooking period and the gases allowed to escape through a ⅜-in. bypass. The digesters in the Brooklyn building are arranged similar to those in the New York building, and vented in the same way through 6-in. main vent lines. The two 6-in. vent lines are carried to the end of the building, where they discharge into the digester vent tank.

Six-inch jet condensers are connected to the digester vent tank for condensing the steam and soluble gases. The discharge line from the condensers is connected to a blow-off tank, where the insoluble gases are trapped and the water overflows to the sewer. The blow-off tank is vented by means of a 4-in. line, which carries the insoluble gases and discharges them into the rear of the boiler furnaces, and thence with the combustion gases from the boilers to the chimney.

The garbage when cooked is discharged from the digesters into receiving tanks underneath, from which it is in turn passed through either roller, steam, or hydraulic presses. Water and free grease are pressed out, flowing through a conduit to grease-separating catch basins. The solids are delivered by conveyors to the drying building, the whole operation being carried on in closed apparatus.

Dryer Gases

The solids from the presses carried to the dryer building are fed into the primary direct heat dryers, which consist of a large circular shell with furnace at the feed end. The material is fed into the dryer, and as the dryer revolves the material cascades, coming in contact with the combustion gases from the dryer furnace, thus evaporating the moisture in the material. The dried material is discharged at the rear of the dryer into conveyors, which carry it to the percolating building. The vapors and gases coming from the dryers enter a large continuous chamber at the rear, which is connected to a flue leading to the chimney. The chimney, which is constructed of concrete, is 17 ft. in diameter and 225 ft. high, and not only takes care of the gases from the dryers, but also serves the majority of the boilers of the boiler plant. The dryer gases before entering the chimney are passed through a steel two-compartment scrubber, where the gases are passed through water spray to condense and take up the soluble gases. The scrubber was installed and placed in operation the latter part of 1914.

The dried material delivered to the percolating building is placed in extractors, and the grease left in the material extracted by means of a solvent. After treatment in the percolating building, it is carried by conveyors to the dryer building and passed through the secondary dryers, which are similar to the primary dryers, and the gases given off pass through a common flue to both sets of dryers, which in turn are connected to the scrubber. The dried material from the secondary dryers is taken by conveyors and industrial cars to the tankage storage building, ready for shipment.

The boiler house contains ten 200-h.p. and twelve 150-h.p. horizontal tubular boilers, which are connected by a flue to the concrete stack. In addition to the above boilers there are four water-tube boilers of 380 h.p. each, connected to separate steel chimneys. The water-tube boilers were installed in 1914. The total rated horse-power of boilers amounts to 5,320 h.p., the steam generated being used in cooking, pressing, percolating and operating steam engines and pumps.

Requirements for Odorless Plants

The type of equipment installed in the plants on Barren Island is similar to that found in the majority of reduction plants. In few plants has the required attention been given to eliminate the undesirable features. Odors from rendering or reduction plants have been due largely to improper equipment and apparatus or to careless operation.

To eliminate odors the following essential features must be considered: 1. The type of equipment used should be such as to produce a minimum amount of gas-carrying odors. 2. The equipment and apparatus used should be designed and installed so as to confine all odorous gases. 3. Proper and sufficient means must be provided to deodorize the gases produced. 4. The equipment and apparatus installed must be operated properly and efficiently.

Proper attention from a sanitary or free-from-nuisance standpoint cannot be expected when sufficient control as to the manner in which the work is to be conducted is not obtained by the municipality. When contracts are awarded in competition for short terms it usually results in the plants being constructed with less attention paid to details and permanent construction. It is an evident fact that when contracts are obtained it is necessary to charge off the larger part of the first cost of the plant during the life of the contract, and that the cost of operation will be increased when it is necessary to consider sanitation and freedom from nuisance as the first object. It is only natural to expect the commercial side to be foremost, unless proper control is exercised by the municipality, whether the work is conducted by contract or by the municipality.

Sources of Nuisance

The odors given off by the garbage reduction plant, causing nuisance to the surrounding territory, come principally from three sources—the gases vented from the digesters, gases escaping from the apparatus, and the gases from the dryers.

The gases carrying odors are treated at the reduction plant so as to eliminate a larger part of the odors, although they are not adequately or sufficiently treated. As previously described, the gases vented from the digesters are passed through condensers where the steam is condensed and a large part of the gases are absorbed by the water. The insoluble gases are trapped in a hot well or vent tank and then vented through a pipe line to the boiler furnaces, so as to raise their temperature sufficiently to deodorize them. From the tests made during this investigation it was demonstrated that by heating the gas to 2,000 deg. Fahr. the odors were not eliminated, but became more irritating as the temperature was increased, due to a change in the sulphur compounds to sulphur dioxide.

The practice of discharging the insoluble digester gases into the boiler furances has been universal in nearly all reduction plants. Mr. Osborn made tests in 1911 on deodorizing gases by heating to a high temperature, demonstrating that the gases could be completely deodorized. In conducting the tests water was used in producing suction on the test line leading to the high temperature furnace, so that after heating the gases were washed. The water was used only for siphoning the gases through the combustion chamber, the tests being made and a conclusion reached from the results obtained at various temperatures, while in reality, as demonstrated by the tests made during the Barren Island investigation, heating changes the sulphur compounds, producing a gas which becomes soluble in water.

The changes recommended call for abandonment of the present practice of discharging the insoluble gases into the boiler furnace, as, on being heated, they are given off with the odor caused by the chemical change.

The greatest source of the odors in the plant of the New York Disposal Corporation is the direct heat dryers used in drying the tankage. From determinations made approximately 175,000 cu. ft. of dryer gas a minute was given off. This gas, previous to the fall of 1914, was carried direct to the chimney and discharged to the atmosphere.

Washing Dryer Gases

In 1914 the company installed a scrubber for washing the gases, so that the odors would be absorbed before entering the chimney. Tests were made which showed that the odors in the gases from the dryers were absorbed by water, but that the scrubber now installed was not as efficient as it should be, due to its design and the manner in which it was operated. The velocity of gas, in passing through the scrubber, should be reduced to obtain effective results, and the application of the water should be such as to ensure the passing of the gases through sufficient curtains of sprays, to reduce the temperature and thoroughly wash them. To obtain satisfactory results the temperature of the gas should be reduced to 100 or 110 deg. Fahr, and the velocity should be at the rate of 300 to 350 ft. a minute, the quantity of water required depending on the quantity and temperature of the gases to be scrubbed.

The water should be applied so as to require all gases to pass through the curtains of water. The velocity of gas should not permit the water to be carried back or to short circuit, so as to prevent sufficient contact. The pressure on the spray nozzles should be such as not to offer too great resistance to the gas, and when using low pressure on the nozzles they should be spaced sufficiently near each other to give the desired curtains of water.

No attempt has been made by Mr. Osborn to state in detail what steps should be taken, and in just what way the work should be done, as it was the object of the investigation only to determine in what way it could be done and whether it was feasible.

Recommendations

As a result of the studies and investigations covered in this report the following recommendations are made for the New York Disposal Corporation plant:

1. That immediate changes be made in the treatment of the insoluble gases vented from digesters through condensers, so as entirely to deodorize them, as the present practice of discharging into the boiler furnace does not deodorize the gases.

2. That special attention be given to keeping all tanks containing digested garbage, or garbage in the process of digestion, free from leaks, and that equipment not absolutely free from leaks when under pressure be kept out of service until repairs are made.

3. That gases shall not be permitted to escape at the time of opening digesters.

4. That special attention be given to all condensers

to ensure sufficient water being used, and at a temperature that will condense all the steam and take up all soluble gases.

5. That the present dryer plant be so constructed or changed as to prevent leakage, and reduce the amount of gases to be treated.

6. That all gases given off from the dryers shall be scrubbed and deodorized thoroughly before being allowed to escape to the atmosphere.

7. That the scrubber now installed be replaced or reconstructed, to enable the volume of gas passing through it to be washed or scrubbed thoroughly.

8. That the water supply at the plant be increased, and, where necessary, pumps be duplicated to ensure sufficient water for condensing and scrubbing of gases at all times.

9. That the pumps be of a type that will assure the required amount of water being delivered, and that they be fitted with meters to show the amount used.

10. That the works and grounds at all times be kept in a clean condition.

11. That the city at all times have inspections made to determine the manner in which the work is being done.

The report is followed by a detailed account of investigations made at the Barren Island plants by the city's Central Testing Laboratory, under the direction of Otto H. Klein.

A Mercury Column Alarm for Water Standpipes[*]

By W. E. Haseltine[†]

FOR several years the company with which the writer is connected had trouble through the overflowing of its water standpipe. Since the standpipe is located in the residential district, its overflow caused a great deal of complaint from nearby property owners, who sometimes threatened damage suits. The company was also annoyed by the freezing of the overflow on the exterior of the standpipe.

There were three major reasons for this overflow occurring in the manner described, and for its continuing so long: (1) The standpipe is located nearly a mile from, and out of sight of, the pumping station. (2) The only means of telling when the standpipe was full was by the pressure gauge at the pumping station, and the indications of this gauge would vary so greatly with the speed at which the pumps were running, the amount of water being used from the mains, etc., that it was not very reliable as an indicator, and unless the pumps were stopped at a point considerably below full standpipe the engineer could never be sure that he was not running it over. (3) On account of the topography of the city, it was quite necessary to fill the standpipe almost to the top at every pumping to avoid an unnecessary amount of stopping and starting of the pumps and an increased pumping expense.

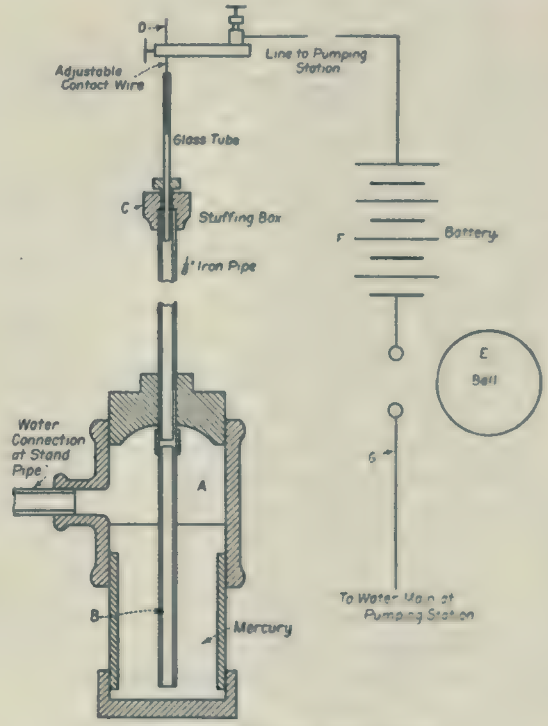
Many schemes were tried for correcting this condition, but with little success. A float making an electric contact was found impracticable on account of trouble with ice and excessive maintenance difficulties in other ways. A spring pressure gauge making an electric contact was also tried, but on account of damage from freezing this gauge had to be located in a damp valve pit underneath the standpipe, and the contacts consequently corroded and went out of business, and the gauge was also continually getting out of calibration.

The idea of a mercury column alarm then suggested itself, and after several attempts the manager succeeded in constructing one which has been in continuous service for almost nine years, and it has never failed to operate unless a wire of the pumping station has in some way been broken.

The accompanying drawing shows the general principle upon which this gauge is made and how it operates. A tap is made in the pipe leading into the standpipe on the standpipe side of the valve controlling same, so that the gauge will never be subjected to excessive fire pressures.

This tap is connected by means of a regular corporation connection to the top of the mercury chamber "A." Extending down into the mercury chamber is a small iron pipe "B" reaching nearly to the bottom, and this pipe extends vertically to a pre-determined height, and about 6 inches of glass tubing is connected to the top thereof by means of a stuffing box "C."

This glass tubing is placed at such a height above the mercury chamber that at the time the standpipe is full the mercury column will stand at about the centre of the glass tube. A metal contact "D" is arranged to slide up and down in this tube, and this is connected to the wire leading to the pumping station, and the electrical circuit completed by the bell "E," the set of batteries or bell ringing transformer "F," and the wire "G" attached to the water main at the station, this main making the return circuit.



Connections of mercury column alarm

The operation of the alarm is simplicity itself, the weight of the water column in the standpipe raising the column of mercury in proportion to its specific gravity until the mercury touches the contact "D," when the bell rings at the station. The specific gravity of mercury being about 13.6, a 100-ft. standpipe would require a mercury column something over 7 ft. high.

This alarm has a number of advantages over others.

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[*] Abstract by Engineering and Contracting of a paper before the American Waterworks Association.

[†] Manager, Ripon Light and Water Company, Ripon, Wis.

It is almost infallible, provided that the joints are made perfectly tight. It never has to be calibrated, and is independent of barometer and practically so of temperature. The latter statement is not strictly true, but it has been found that the gauge operates perfectly at all temperatures from 100 deg. above zero to 40 deg. below.

The fact that 1 in. of mercury is practically equivalent to 1 ft. of water makes it easy to set this gauge so that the point of ringing the bell at the pump house will not vary 1 inch in the standpipe, which cannot be said of an alarm based on any other principle.

The entire outfit can be made by any one at an expense not to exceed $20 or $25 outside of the line wire.

About the only precaution recommended is: Be sure to use an iron mercury chamber and iron pipe. Ignorance of the fact that mercury would attack brass was the cause of much grief at Ripon, and led to the loss of large quantities of mercury. The final mercury chamber was made out of a short section of 2-in. pipe and a riser out of ⅛-in. ordinary black pipe.

The Binder Course in Asphalt Pavements

By Robert Klotz*

PRESENT-DAY practice in sheet-asphalt and asphaltic or bituminous pavement construction for city streets, and discussions of defects in such pavements, show evidence of a constantly increasing tendency to overlook the purpose and importance of what is known as the "binder course," even to the extent of entirely eliminating this course or any substitute for it.

The various schemes and devices brought forward from time to time for the purpose of eliminating the wave effect met with in pavements of this character lead to the conclusion that a gentle reminder of the nature of and reason for the binder course might be of value to those interested in the question of economical pavement maintenance.

The purpose of the binder course is, as its name implies, to bind the top layer or wearing surface of the pavement to the base, whether the latter be of concrete, granite block, macadam, or other material. The mixture used for the wearing surface is designed to form, under compression, a reasonably hard, durable, and impervious covering, and being therefore comparatively low in bitumen has little if any power of adhesion.

The binder course originally used consisted of graded gravel thoroughly coated with coal tar, or coal-tar pitch, and laid at a temperature sufficiently high to provide for good adhesion to the base and to the surface layer.

The coal tar or pitch was later replaced by asphalt or asphaltic cement, presumably because of the increased difficulty of obtaining tar economically, due to the development of the water-gas process for the manufacture of illuminating gas and the consequent reduction in the quantity of commercial coal tar produced, and because of the decreased cost of the asphalt and its availability as part of the stock of the mixing plant. While the adhesive power of the binder thus produced was apparently lower than that of the tar-binder, it was still sufficient to provide the binding action required to prevent the forming of waves in the surface.

Within the last three or four years the various asphalt companies have introduced, apparently with a view to economy, what is commonly referred to as a close-mixture binder, which consists of broken stone screenings, varying from about a 1-in. size downward, covered with hot liquid asphalt. Owing probably to the reduced first cost of the pavement thus obtained, the use of this type of binder has been permitted under certain specifications, and quite a considerable area of this pavement has been laid.

The writer's experience with this type of binder, particularly on repair work, has shown that the old-style, or stone, binder is far more preferable and the one to be relied on to prevent the formation of waves in the pavement surface.

Owing to the decreased viscosity of the asphalt necessary to provide for the proper mixing of close-mixture binder, the coating on the particles of stone is comparatively thin. This makes the mixture subject to cooling below the critical temperature, within the time required for delivery and laying. The weight of the roller is more evenly distributed over the surface of contact between the binder and the base, and the pressure on the individual particles of stone is insufficient to bring the hotter portion of the more or less hardened coating into intimate contact with the base.

With new pavement the unfavorable behaviour of the "close mixture" is less evident than when an old pavement is repaired, due, no doubt, to the greater care and the more exacting supervision.

The action of an asphalt pavement where no binder course is used was brought very clearly to the writer's attention during 1912, when he was in charge of certain pavement repairs in the city of New York, all of the work being subject to the city's specifications and inspection.

During the early part of that year an order was issued to the effect that when repairs were required on asphalt pavements where the thickness of the original pavement, consisting of 1 in. of binder and a 2-in top course, had been reduced to 1½ ins. or less (that being the newly specified thickness of the top course), the binder course was to be omitted.

The writer managed to avoid almost entirely the forming of waves in the pavement, which he felt certain would be the result of literal adherence to this order, by having the base spattered or painted with a coating of hot liquid asphalt immediately before laying the top-course mixture, this asphalt acting as a very efficient "glue." Repairs made under the direct supervision of the city authorities on the same streets and subject to the same traffic, without the thin but effective layer of adhesive, showed waves within from two to three days after laying, and were destroyed by the action of traffic within two or three weeks.

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*Writing in Engineering News

While various theories have been advanced from time to time to account for the waves formed in asphalt pavements, some of them apparently based upon sound reasoning, practical experience seems to show that, whatever may be the particular action of traffic which causes them, waves can be avoided by providing a proper bond between the pavement proper and the base, and that three-wheel rollers, etc., are unnecessary and inadvisable complications to attempt to insert into the science of constructing and maintaining bituminous pavements.

An example of the need for special care in the construction of the binder course is shown in some work carried out by the writer in New York City in 1910, the area involving about 250 sq. yds. of sheet-asphalt pavement located in and around two underground-conduit car tracks with a double branch-off and curves, both being crossed constantly in the same direction by exceedingly heavy traffic. Frequent repairs had been required at this point owing to the rolling effect of traffic, the asphalt being continually forced against the rails and ground off as it reached the level of the head.

The re-laying of the entire area was required upon the reconstruction of the tracks, and the work was carried out during the night and the early morning to permit laying the pavement without seriously hindering traffic. Under the circumstances, the supervision of the city authorities was not as definite and exacting as might have been the case had the work been done
The total number of building permits for June3S
during regular hours; and as the sub-base was known to be of a sufficiently dry and porous nature to permit of the proper setting of the base, the asphalt was laid on the "green" concrete, which had been in place from 3 to 12 hours.

This pavement remained in place for over 2½ years under the same traffic conditions as previously, the only repair required being one small patch where the asphalt had been disturbed by a loose rail joint.

Sad to relate, this area was almost entirely removed in connection with subway construction at the end of the time mentioned. A more extended record of its behaviour would probably have been of considerable value, although the writer feels that the performance up to the time of removal was sufficiently marked to warrant more consideration of a proper joining of the pavement and the base than seems to be the practice at present.

Oil Paint on Cement

There is some difficulty in making paint adhere to cement, but if the cement is first washed with 1 per cent. of sulphuric acid (one part concentrated acid to 100 parts of water), rinsed, and allowed to dry thoroughly, the paint will find the surface suitably prepared for adhesion. Or the cement may be covered with three coats of water glass (silicate of soda), one part to four parts of water, and then painted. A first coat of linseed oil varnish followed by the usual paint is effective.

At Brantford, Ont., the total number of building permits for June was 136, while the total value was $154,030, an increase of $49,520 over the corresponding month of last year.

Complete Railway Aids Construction of Welland Ship Canal

In connection with the construction of the Welland Ship Canal a double-track railway with stone ballast and 60-lb. rails has been built by the Canadian Government. The railway extends from a point just north of the town of Thorold to Lake Ontario, a distance of seven miles, and its construction is for the purpose of handling excavated material from the canal prism to two long dumps in the lake forming the new Lake Ontario entrance to the canal, and for the handling of crushed stone excavated from the site of the flight locks in Thorold to the other lock sections of the canal to be used as aggregate for concrete. A large crushing plant has been erected with a capacity of 4,000 tons a day, and both this plant and the railway are now in active operation.

Since it is expected that during the summer, when all contracts are under way, there will be a train every five minutes, the entire line has been equipped with a block signal system.

The construction of the road was in charge of J. F. Pringle, railway engineer, under the direction of J. L. Weller, Engineer-in-Charge, Welland Ship Canal.

Cent Wise and Dollar Foolish

Saving in one way sometimes involves expense in other ways that more than offsets the prospective gain. The president of a prominent construction company states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column. On the other hand, the increase in form cost was $5.70 per column, entailing a loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size columns on successive floors than to reduce the dimensions. One way to avoid frequent changes in columns sizes is to vary column reinforcement in successive storeys.

A new kind of level for builders and others is designed to show the deviation from either horizontal or vertical in inches or fractions to the foot. It has a pan half-filled with colored spirit and covered with a glass face, and over this is a dial with two accurately graduated scales. The outer scale gives horizontal deviations, the inner making known the inclination from the vertical. The liquid, which is always level, is seen as a narrow semi-circular rim between the two scales and the reading at the end of this liquid curve may indicate the pitch of a rafter or other desired measurement.

The pneumatic method of placing concrete was used successfully for conveying the mix 2,805 feet through a 6-in. pipe on the Mile Rock tunnel work at San Francisco. The compressor capacity installed was 1,200 cu. ft. a minute, and the receiver pressure was kept at about 115 lbs. a square inch. This is regarded as a record for long-distance work of this character.

The building permits taken out during June at Kingston, Ont., covered work of an estimated value of $39,470, as against $16,797 for June of last year. The value of the work for which permits were taken out since the beginning of the year is estimated at $118,494. For the same period last year it was $176,072.

Method of Measuring Stone

IS there any fixed custom in the building trade as to the method of measuring up building stone? This was one of the crucial points debated in a case which came before Justice Elwood in the Supreme Court recently, when John B. Davies, contractor, of Saskatoon, sued Richardson Builders, Limited, for $2,821.85, the balance of an account which the plaintiff alleged was due for excavation and the cost of stone supplied for a building at the University. The particulars of the work done and material supplied were as follows: To excavating 4,367 yards at 35 cents a yard, $1,528.45; to excavating 652 yards at 45 cents, $293.40; to 350 cords of stone supplied, at $20 a cord, $7,000; total, $8,821.85. It was contended that $6,000 only had been paid on this account, leaving $2,821.85 due to the plaintiff.

On behalf of the defence it was contended that the total amount earned for excavation was only $1,636.10, and that this amount had been paid in full to the plaintiff, and, with respect to the stone, that only 260 cords had been supplied. The defence also contended that the price of the stone supplied by the plaintiff was $5,200, and that before the action was brought the defendant paid the plaintiff towards this amount the sum of $4,363.90, leaving an unpaid balance of $836.10. The defendants also stated that before the action was brought they assigned to the Canadian Bank of Commerce, Saskatoon, $477 on account of money unpaid to plaintiff by the defendant on the price of the stone. The defendant also paid into court in satisfaction of the plaintiff's claim, not including costs, $359.10, being the unpaid balance of $836.10 less the amount of $477 assigned to the Canadian Bank of Commerce.

Considerable interest was manifested in the case among the builders and contractors in Saskatoon. Evidence was given in support of the claim by the plaintiff and his son, and others, their evidence being chiefly with regard to the amount of stone which had been delivered as shown by various measurements. John Oliver stated that in computing the amount of stone supplied he took the length and width of the box wagons and the average height or sky-line of the load.

Geo. T. Clarke, vice-president and engineer for the defendants, swore that the total amount of the stone delivered was 260 cords, and that he arrived at this estimate by measuring the stonework in the wall in which the stone was used and adding thereto 28 per cent., which he said was the usual practice. He also took into consideration 12 cords remaining on the ground.

Frank Davies, son of the plaintiff, in the course of his evidence said that in one instance at least the amount contained in the loads must have been guessed at.

His Lordship, in giving judgment, said he must apply common sense in arriving at a decision, and it appeared to him that there was a strong probability that there had been a great deal of guesswork in arriving at the quantity of stone contained in the loads. He pointed out that there was a great deal of difference in measuring loads separately and measuring 640 loads of stone piled up, because it was impossible to get at the exact amount in each load, and therefore there would be 640 variations, and this might make a very considerable difference in the total. He considered that the weight of the evidence was in favor of the defendant, and there would be judgment for the plaintiff for $359.10, the amount paid into court and the costs up to the time of the action being brought, and judgment for the defendant for the costs incurred subsequently.

R. W. Davies appeared for the plaintiff, and Donald Maclean for the defendant.

Personal Mention

Mr. R. O. Wynne-Roberts, until recently Consulting Engineer to the city of Regina, has been elected a member of the American Society of Civil Engineers.

Mr. John Shaw has relinquished his duties as Town Engineer of North Bay, Ont. He is succeeded by Mr. H. McAuslan, who received much of his preliminary training under Mr. Shaw.

Mr. L. E. Carrothers, architect, of London, Ont., announces that he has opened an office at Room 58 in the Bank of Toronto Chambers in that city, and will be pleased to receive manufacturers' catalogues.

Mr. G. R. G. Conway was the guest of honour at a dinner given by the staff of the British Columbia Electric Railway on June 26th. The dinner was given on the occasion of Mr. Conway's retirement from the position of Chief Engineer to the company, in order that he may remove to Toronto and open offices as a general consulting engineer. He was presented by the employees of the company with a silver rose bowl.

Mr. W. A. McLean, Chief Engineer of Highways for Ontario, gave an address on the subject of good roads in the Town Hall at Owen Sound recently. Mr. McLean said that Grey County is in a position to build good roads as cheaply as any county in Ontario—the foundation is there already, the sub-soil for drainage is good, and the material for road-making is right at hand. Mr. McLean described methods of roadbuilding, and illustrated his remarks by lantern slides.

Mr. H. E. Tanner has been appointed City Engineer of Verdun, Que., in succession to Mr. Henry Hadley, Junr., who has resigned to go to the front. Mr. Tanner, who was born in Richmond County, Que., has been engaged in metallurgical research work at the Institute of Technology, Pittsburg, Pa. He was for two years assistant to the Town Engineer of Chicoutimi, Que., and also was engaged for three years on the engineering staff of the Transcontinental Railway.

Sapper George E. Revell, who is reported killed in action in Europe, enlisted for active service in Nelson, B.C., where he was practising his profession as a civil engineer. Sapper Revell was born in Woodstock, Ont., and graduated from the School of Practical Science of the University of Toronto.

The death is reported of Mr. Patrick McSherry, of Toronto. The late Mr. McSherry was a widely-known surveyor, having been connected with Government surveying work for many years.

One of Canada's oldest railway contractors, in the person of Mr. H. G. Taylor, died recently in Montreal at the age of 83. It was only a year ago that illness compelled Mr. Taylor to relinquish his duties as Mechanical Superintendent for the Montreal Tramways Company, a post which he had held since before the electrification of the system. He was born in Hampstead, N.H., and came to Canada at an early age. He was associated with the building of several railroads in Ontario and Quebec, including the Midland Railway, now part of the Grand Trunk System, and the Lake Erie and Detroit River Railway, now absorbed by the Pere Marquette Railway.

Mainly Constructional

East and West From Coast to Coast

Ontario Supplementary Letters Patent have been issued increasing the capital stock of the Swedish Crucible Steel Company of Canada, Limited, from $100,000 to $200,000.

L. A. Ott & Company, New Birks Building, Montreal, have received a contract for the grading of the battle fields of the Plains of Abraham, Quebec. The contract was awarded by the National Battlefields Commission.

The excavation for the new infirmary building on the mountain top at Hamilton, Ont., has been completed, and the form work is ready for the concrete. It is expected that the building will be completed early next winter, at a cost of $100,000.

The Montreal Board of Control have awarded to G. M. Gest, Limited, Montreal, the contract for the construction of 2,000 feet of underground conduit, with branch lines to outside lamp posts along the main line of conduit, in connection with the filtration plant now being constructed.

A tentative scheme has been submitted by Mr. Willis Chipman, consulting engineer, of Toronto, respecting the proposed extension of the sewage disposal plant at Guelph. He recommends additional filtration beds and the construction of a new septic tank at a cost of $55,000.

The Dominion Lime Company, Limited, has been incorporated at Madoc, Ont., with a capital stock of $100,000. The company are authorized to manufacture and sell Portland cement, marl, kirselguhr clay, bricks, lime, drain tiles, and artificial stone. The Provisional Directors are S. Wellington, C. R. Ross, and W. H. McBain, all of Madoc.

The Board of Works of Kingston, Ont., have appointed a sub-committee to take up the matter of relieving the City Engineer of some of his outside duties with a view to facilitating the work. It is proposed that an expert should be engaged to supervise the laying of pavements, and if any outside help is provided it will probably be along this line.

The Montreal and Southern Counties Railway Company are continuing their electric line to Granby, P.Q., an addition of 15 miles, the contract being carried out by the Grant Campbell Company. A sub-station will be built at Granby, making four sub-stations on the entire line of 46 miles. At present the extension is being graded, there being 250 men employed on this work.

With a capital stock of $25,000, the Carmichael Waterproofing Company, Limited, has been incorporated at Toronto, Ont., to manufacture and deal in all kinds of weatherproof building materials, including metal work, roofing, and building paper. The Provisional Directors are H. Howitt, B. F. Fisher, W. N. Robinson, G. R. Monteith, and P. N. Hotson, all of Toronto.

J. Chartier et Compagnie, Limitee, is the name of a company incorporated at Montreal recently, for the purpose of carrying on a general contracting business, erecting public and private buildings, and constructing canals, dams, bridges, piers, etc. The capital stock of the company is $50,000, and the incorporators include J. Chartier, J. F. Chartier, J. Bumbray and J. E. C. Bumbray, all of Montreal.

The Nova Scotia Car Works, Limited, have approached the city of Halifax for an advance of $135,000 to enable the company to start work on orders amounting to $400,000. Up till now the company have been unable to finance the work, but it is said that if the city will grant financial assistance the work can be started. The city have promised that the request of the company shall be considered.

It is understood that the Pease Foundry Company, of Brampton, Ont., have received an initial order for 100,000 shells. The manufacture of this quantity will give employment to thirty men for eight months. Mr. McKinnon, of the company, is in New York making arrangements for the installation of the necessary machinery. He expects to have a staff at work on the order within a short time.

Work will be started immediately on a three-storey building for the Merchants' Bank at Granville and Pender Streets, Vancouver, to be constructed at an approximate cost of $175,000. It will occupy the 50-ft. frontage on Granville Street where the Bank's main office now stands, and will have a depth on Pender Street of 104 ft. It is expected that the new building will be completed in about twelve months.

At a recent meeting of the Toronto Board of Control Mayor Church moved that the Works Commissioner report on the cost of establishing a civic car construction shop for the building and repairing of cars and other railway equipment needed by the city. This is the first step towards the establishment of facilities which will be needed when the city goes into the street railway business on a large scale.

At Lachine, Que., the Lachine Manufacturing Company, Limited, has been incorporated with a capital stock of $120,000, the incorporators being J. A. Descarries, T. N. Descarries, A. Descarries, R. LePailleur, J. A. P. Descarries, and J. W. LePailleur, all of Lachine. The company will manufacture metal work generally, including munitions of war, and for that purpose are authorized to act as contractors for public and private works.

Permission has been given by the Quebec Public Utilities Commission to the Laval Electric Company to carry their transmission line through the streets of the parish of St. Elzear upon condition that the company supply light and power to the municipality and residents upon the most favourable terms granted by the company. All questions regarding the location of the line and its erection and any difficulties that may occur will be adjusted by the Commission.

It is reported that more work is being done and more men are employed than ever before at the plants of the Nova Scotia Steel Company and the Eastern Car Works, New Glasgow, N.S. There are now 1,100 men on the Steel Company's pay-roll at New Glasgow, and it is understood that the Car Works will employ no less than 1,500 men as soon as they can secure them. Several departments of the Steel plant are working continuously with three eight-hour shifts a day.

The municipality of Montreal North have accepted plans for a main drainage scheme drawn up by Mr. F. C. Laberge, of Montreal, and have awarded the contract for the work to Mr. J. Chartier, Montreal, at the price of $127,000. The drains, which are to be constructed of concrete, will run the entire length of the town, and will discharge into the Back River at two points, the pipes being carried 600 feet into the river. The largest drains will be 2 ft. 4 ins. x 3 ft. 6 ins. The drainage of Pie IX Boulevard is included in the contract. At a later date it is intended to construct a purification plant, preliminary plans for which have been drawn.

The soundings of the Valley Inn Marsh on the route of the new Toronto-Hamilton highway have been completed. According to Mr. Macallum, City Engineer of Hamilton, solid clay was found in the marsh at a depth of between 40 and 50 feet. The result of the soundings will probably mean the adoption of Engineer Armstrong's scheme of a filled-in road across the marsh. Those in charge of the plans for the municipalities interested are expected to meet shortly and decide this point.

According to Mr. W. S. Kickley, the Local Manager, the Ford Motor Company of Canada contemplate the erection of an assembling plant in the city of Calgary, Alta., that will ultimately represent an investment of half a million dollars. The proposed construction involves the use of reinforced concrete. The Railways and New Industries Committee of the City Council have recommended that permission be given the company to cross Eighth Street West with a spur track, conditional on the erection of the structure.

Toronto's usual monthly announcement that work is to be commenced on the new Union Station by the first of next month has been made by city officials. The latest reason put forward for an early start, according to press reports, is an arrangement with the Bank of Montreal for advances of four million dollars on the guarantee of the Canadian Pacific and Grand Trunk Railways. Railway men are not so certain of the matter, however, and fail to see why the railroads should be willing to spend so much money on a new station when the old one can be made to answer for a time, at least.

Under the Mines Department of the Dominion Government an experiment is being made at Edmonton, Alta., to test McMurray asphalt as a paving material. The Mines Department will bear all the expense of laying the asphalt, while the city will lay the concrete base and curbs. A section of street 300 feet in length will be used for the experiment, half the distance being covered with a two-inch sheet of asphalt, and the other half with a three-inch layer of bitulithic—asphalt mixed with finely crushed rock. It is intended to find out which of these pavements gives the best results under equal traffic conditions.

The new Marine Drive extending from North Vancouver through the municipalities of West Vancouver as far as Caulfie, a distance of about ten miles, will probably be opened at the end of the month. The total cost of the work at present undertaken will be over $300,000, and it is only the beginning of a road that will be carried still further round the coast in course of time. It is the most ambitious piece of work yet attempted by the municipality of West Vancouver. There is no doubt that it will assist materially in putting that town on the map, as the new drive will form one of the finest automobile roads in the province.

Work on the Yonge Street subway at North Toronto has made such progress that Engineer Ripley is reported as saying that the road will be opened before it freezes in. The grading has been completed to the full depth of 18 feet, and the concrete work will start immediately. The water-mains have been lowered already, and the installation of Hydro wires, gas-mains, and telephone wires will be commenced without delay. The eastern abutment is completed to within 30 feet of the sound end, and this part of the work should be finished within another two weeks. Day and night work is being carried on with the concrete that will carry the bridge superstructure.

The Royal Bank of Canada have moved to their new quarters in the twenty-storey Royal Bank Building at King and Yonge Streets, Toronto. The Bank has leased the ground floor and a portion of the twelfth floor for a period of years. The groundwork in connection with the counters and railings is finished to harmonize with the color scheme of the interior marble, and the general lighting of the room is accomplished by concealed indirect reflectors arranged to ensure the best architectural effect. The executive and supervisor's offices will be on the twelfth floor, but they will not move from their old quarters till later on.

The committee representing the municipalities interested in the new Toronto-Oshawa road which was appointed at the recent meeting in Toronto (as reported in our last issue) met at Whitby last week and unanimously decided that the road should be constructed of macadam similar to that now in use on the Kingston Road from the Toronto city line eastward to the Grand Trunk crossing. Three engineers from the Department of Public Works, who went over the road previous to the meeting, were present to explain the plans. The Government is being asked to make an estimate for a standard grade of 3 per cent., the same as that on the Toronto-Hamilton roadway.

Rapid progress has been made on the foundation work for the Don Valley section of the new Bloor Street Viaduct, Toronto, during the last few weeks. Work is in progress on each of the six individual piers, which are in different stages of construction. At pier "B" the contractors tried a different procedure by excavating only half of the required foundation at once. One-half has been excavated and filled with concrete to a depth of ten feet. Considerable apprehension was caused by the close proximity of the excavation for pier "C" to the C. P. R. track; special precautions were taken to avoid a land-slide through the heavy traffic passing over the line. Between piers "C" and "D" an earth fill has been made varying in depth from three to six feet. At pier "D" concrete work is going on finely, and the first round of neat work has been completed. The concrete on this work is being placed through a chute from a tower with a bucket elevator. The excavation for pier "E" is partially completed, but contains about six feet of water. On account of the higher level the excavation for pier "F" has been comparatively easy, and no water has appeared to hamper the work. At present there are about 228 men employed on the work.

Mr. J. Stadler, of Shawinigan Falls, Que., writing on the subject of Quebec roads, criticizes the manner in which some highways are being constructed. For instance, certain portions of the new Three Rivers and Louisville road he considers will not be permanent owing to the material used and the method of drainage. On a trip from Three Rivers to Montreal he noticed that, instead of using large stones or boulders at the base of the road, sand and stone dust were employed. In other portions of the province, Mr. Stadler states, the work is bad—due, he believes, to insufficient supervision. In support of his contention that the base of the roads is poor and the drainage insufficient Mr. Stadler quotes the following report of some Swiss engineers who inspected many roads in Canada and the United States: "The northern part of America (Canada) has only a very few miles of road, and considering the short time these roads have been built we cannot consider the routes as a factor in our report. Our general observation, however, is that, having in mind the climatic conditions, the roads are built rather for apearance than for durability; the drainage—such an important factor in cold climates—is grossly neglected; the depth of the porous material in a good many instances is insufficient for the amount of traffic; and often the width of macadam road is too great to afford an economical investment."

Messrs. B. & S. H. Thompson & Company, Limited, of Montreal, agents for The Crittall Steel Casement Company, of Braintree, England, have secured the contracts for the steel casements for the new Civic Library at Montreal, and for the Ross Pavilion of the Royal Victoria Hospital.

The following contracts have been awarded to the Toronto Equipment Company, Limited: one from the city of Hamilton, Ont., for three 24 x 24 Chapman rectangular sluice gates, and one from the town of Transcona, Man., through the British Canadian Engineering Company, of Winnipeg, for two De Laval 8-inch vertical single-stage sewage pumps, having a combined capacity of three million gallons a day.

At Maisonneuve, Que., where road work is expected to amount to a million dollars this year, a departure from the ordinary method of constructing the concrete foundations for asphalt roads is being made by the Paving and Construction Company, who have the contract for the work. This departure is in the use of steel bar reinforcement. It is understood that the requirements for this material will amount to between eight and twelve hundred tons of ⅝-in. square twist bars in lengths of 25 feet and 32 feet. The Burlington Steel Company, Limited, of Hamilton, who have the order for the reinforcement, are supplying only rail carbon steel bars, on account of the requirements for a bar of high tensile strength.

Another successful example of the Canadian Blower & Forge Company's Exhaust Systems is the one installed for the British Insulated & Helsby Cables Company, Limited, Prescot, Lancashire, England. The fan used is a No. 45 Canadian slow speed, high efficiency mill exhauster with direct connected motor. Fifteen machines and six floor sweeps are served, and the system is operating well, requiring 6 h.p. for the motor. The unusually good result is due as much to the design of the piping as to the high efficiency of the fan itself, which is operating at a pressure of less than three ounces, and with a uniform velocity in the pipes of less than 3,000 feet a minute. This low velocity is possible only when the frictional resistance is estimated carefully, so that the draught at every hood is the same; in fact, a sweep-up at the end of the exhaust pipe has just as good a suction as the hood nearest the fan. The discharge from the fan is carried about 100 feet outdoors to a cyclone collecter in the boiler house. The total length of the system is 280 feet.

Trade Inquiries

The Weekly Report of the Department of Trade and Commerce contains the following inquiries relating to Canadian trade. The names and addresses of the firms making these inquiries can be obtained by those specially interested in the respective commodities upon application to the Inquiries Branch, Department of Trade and Commerce, Ottawa:

760. **Pipe-wood staves.**—A South African commission house requests correspondence with complete information on patent wood staves for water pipe lines. Full particulars are requested in reference to the tools required for putting these pipes together, as they will have to be shipped in the knock-down state.

762. **Railway material, locomotives, etc.**—A London correspondent who has for some years been the representative of large continental manufacturers of railway material, locomotives, gas engines, etc., is open to act as agent for Canadian manufacturers.

765. **Machinery, hardware, building materials, etc.**—A firm of engineers in London wishes to get into touch with Canadian firms manufacturing machinery, hardware, building materials, etc., who seek agents in the United Kingdom or selling agents in South Africa and other parts of the Empire.

797. **Gas tubes.**—A firm in Birmingham are in the market for gas tubes, and would like to hear from Canadian manufacturers.

798. **Carborundum discs.**—A Dutch firm are in the market for carborundum discs, 30 cms. in diameter, with a central hole of 35 mm., made of steel with borders of carborundum 6 mm. width, for shipment to Spain, and would like to hear from Canadian manufacturers.

802. **Representation in Great Britain.**—A British firm with good connections in the building and engineering trades throughout Great Britain desire to represent Canadian producers of standard lines, particularly asbestos, timber, railway sleepers, etc.

804. **Annealed and barbed wire, wire nails, etc.**—A London firm wish to obtain quotations from Canadian manufacturers of annealed and barbed wire, wire nails, etc.

808. **Hack saws.**—An engineering firm in Barbados would like to have catalogues and illustrations from Canadian firms manufacturing small engineering machinery, particularly hand and power hack saws.

810. **Explosives.**—A manufacturers' agent in Buenos Ayres would like to enter into communication with Canadian explosive manufacturers.

811. **Manganese castings and Decouville wagons.**—A British firm of engineers and importing merchants, well known in Buenos Ayres, who handle all kinds of heavy machinery, iron, steel and wire, desire to import manganese castings, manganese rail joint castings, and Decouville wagons.

814. **Trade with Russia.**—One of the largest houses in Moscow, who specialize in trade with Siberia, where they have ten branches, are in the market for the following, and would be pleased to hear from reliable Canadian firms: Bolts and nuts; gas tubing, iron; boiler tubes, iron; wire nails; wire of all kinds, including barbed wire; portable engines; rock drilling machines; metal turning lathes; miners' shovels; chemicals, heavy; calcium carbide; acetate of lime; coal tar products—viz., pitch, carbolic acid, creosote, sulphate of ammonia, sulphate of soda; graphite; news and printing paper; wrapping and packing paper.

815. **Steel bars.**—A correspondent in England desires the addresses of Canadian manufacturers who have representatives in Great Britain and who are in a position to supply bars for ferro-concrete purposes. These are ordinary mild steel bars for a tensile strength of from 28 to 32 tons to the square inch.

Attention may be called to Trade Inquiry No. 814, which has been forwarded to the department by Mr. C. F. Just, Special Trade Commissioner to Russia. This inquiry refers to one of the largest houses in Moscow, who specialize in trade with Siberia, where they have ten branches, and who are in the market for the goods listed, and would be pleased to hear from reliable Canadian firms.

Quotations should be c.i.f. Vladivostok, with best terms. This firm have done a large business with Germany on long credit. Reasonable credit is expected. In sending catalogues five copies are required for use of the head office in Moscow and branches in Siberia.

The mining shovel used in Siberia is made for the market in the following weights and sizes, with well riveted handle socket, and in the curved pointed shape:—

No. 1	330	275	1.300
No. 1½	330	300	1.500
No. 2	340	290	1.500
No. 3	360	295	1.700

Quotation per 100 kilogrammes.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Canora, Sask.
The Town Council are considering the installation of a waterworks system at an estimated cost of $17,700. Engineers, Chipman & Power, Mail Building, Toronto.

Chatham Township, Ont.
Tenders will be received until July 17th by W. H. Wickens, Scane Block, Chatham, for the construction of a dam, dredge drains and dash wheel and the installation of pumping machinery. Engineer, W. G. McGeorge, 153 Queen Street, Chatham.

Tenders on the construction of Sylvester Drain will be received until 1 p.m. July 17th, by Commissioner J. A. Miller, Lot 12, Concession 7, Eberts. Plans and specifications with the Engineer, W. J. McGeorge, 153 Queen Street, Chatham.

Fort Erie, Ont.
The Municipal Council have received tenders for the construction of a macadam road from North Line to Buffalo Ferry. Clerk, W. Simmons.

Grimsby, Ont.
Plans have been prepared for watermains to be laid under the supervision of the Town Engineer, C. Bromley. About 8,000 feet of 4-inch pipe will be required.

Guelph, Ont.
The City Council have been ordered by the Provincial Board of Health to lay iron watermains between Victoria Bridge and the Pumping Station. Chairman of the Water Commission, G. B. Ryan.

Lavant Township, Ont.
The Township Council have passed a by-law providing for the construction of a road from Lavant Station to Folger. Clerk, W. Browning, Lavant Station.

Matheson, Ont.
A by-law, providing for the installation of a waterworks system, will be submitted to the ratepayers on July 16th. Estimated cost, $20,000. Clerk, F. R. Rockall.

Niagara Falls, Ont.
The City Engineer, F. J. Anderson, will receive tenders until noon, July 19th, for laying about 50,000 square feet of concrete sidewalk, and 9,000 feet of curbing.

St. Thomas, Ont.
The Town Engineer, M. Ferguson, has submitted two plans for sewage disposal, estimated to cost $15,000 and $9,500 respectively.

The Pas, Man.
The installation of a waterworks and sewage system is contemplated by the Town Council. Approximate cost, $80,000. Clerk, H. H. Elliott.

Thurlow Township, Ont.
Tenders on the construction of a quantity of cement sidewalks will be received until July 20th by W. C. MacDonald, Belleville, R. F. D. 109.

Toronto, Ont.
Permission has been granted to the Board of Control to construct a permanent road bed for a street car line on Bloor Street West, from Dundas Street. Estimated cost, $125,000.

The York Township Council have been asked by Engineer E. A. James, 57 Adelaide Street E., Toronto, to pass a by-law for the construction of an asphalt roadway on Dundas Street west of the city limits. Approximate cost, $19,000.

Vernon, B.C.
The Municipal Council are considering the construction of an auxiliary pumping station, estimated to cost $3,000. One large capacity pump and 50 h.p. motor will be required. Clerk, D. G. Tate.

Winnipeg, Man.
The Board of Control will call for tenders shortly on the construction of a sewer on Stafford Street. Secretary, M. Peterson.

The laying of watermains on Wellington, Cambridge and Academy Streets is being considered by the Board of Control. Engineer, W. P. Brereton.

CONTRACTS AWARDED

Cayuga, Ont
The Town Council have let a contract for laying concrete sidewalk to Frank McMullen, Cayuga, at 10c per square foot.

Ingersoll, Ont.
The contract for the construction of brick pavement, curbs and gutters on Thames and King Streets has been let by the Town Council to the Municipal Construction Company, Berlin, at $2.60 per square yard. Approximate total cost, $18,200.

London, Ont.
The City Council have let the contract for laying asphalt pavement on York and Talbot Streets to the Standard Paving Company, Central Chambers, Ottawa, at $34,000.

Toronto, Ont.
The Board of Control have awarded the contract for the construction of sewers on Dundas Street to Longo & Gentile, 663 Markham Street, at $4,650.

Transcona, Man.
The Town Council have let the contract for the supply of sewage pumps to the British Canadian Engineering & Supply Company, Limited, 122 Phoenix Building, Winnipeg.

Windsor, Ont.
The City Council have let the contract for the supply of cast iron water pipe to the National Iron Works, Limited, Cherry Street, Toronto, at $30.25 per ton, and for specials, valves, hydrants, etc., to the Kerr Engine Works, Walker Road, Walkerville.

Railroads, Bridges and Wharves

Chatham Township, Ont
Tenders on the erection of four steel and concrete bridges will be received until July 17th by James A. Miller, Eberts.

Haldimand & Simcoe Counties, Ont.
Tenders on the construction of a reinforced concrete culvert will be received until July 21st by G. Hammond, R. R. No. 2, Port Dover, and E. Boughner, Colborne Street, Simcoe. Plans and specifications with the Engineer, G. R. Marston, Simcoe, and W. G. Clarke, R. R. No. 5, Hagersville.

Lanark County, Ont.
The County Council are considering the erection of a bridge. Clerk, W. A. Moore, Perth.

Summerville, Ont.
Extensive repairs to a bridge on Dundas Street have been decided on. Clerk to York County Council, R. W. Phillips, 57 Adelaide Street East, Toronto.

CONTRACTS AWARDED

Bruce Township, Ont.
The following contracts for bridge construction have been let by the Township Council:—Willow Creek Bridge, cement work, J. A. McKinnon, Paisley R. R. No. 20, and steel work, Hunter Bridge & Boiler Company, Queen Street, Kincardine; Base Line Bridge, general contract, R. Begg, Port Elgin.

Dorchester North Township, Ont.
The contract for the erection of three concrete bridges has been let by the Township Council to R. E. Waltham, Parkhill, and J. F. McLean, Lucan.

Grand Bend, Ont.
The contract for the construction of two cement bridges for the Huron County Council has been let to J. Lawson, Crediton P.O.

Public Buildings, Churches and Schools

Berlin, Ont.
Tenders on electric wiring and fittings for the Post Office will be received until 4 p.m., July 23rd, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with T. A. Hastings, Postal Station F, Toronto, at the Post Office, Berlin, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

East Kildonan, Man.
The Municipal Secretary, H. Thomson, will receive tenders until July 19th for alterations to a building for a Municipal Hall. Plans prepared by the Municipal

Engineer, 216 Chambers of Commerce Building.

Fort William, Ont.
Work has been commenced on the erection of the Registry Office. Contracts for heating, plumbing and electric lighting have not been let.

Hamilton, Ont.
Tenders on the erection of a fire escape at the City Hall will be received until July 20th by the Mayor, C. S. Walters. Plans and specifications at office of the Clerk, S. H. Kent.

Huff's Island, Ont.
Tenders on the erection of a school will be received until July 19th by the Chairman of the Board of Trustees, W. Barber, Belleville. Architect, G. A. Bennett, Victoria Avenue, Belleville.

Matchedash & Tay Townships, Ont.
Plans of a school are being prepared by J. H. Robertson, Orillia, for the Trustees of School Section No. 16. Brick construction, metal roofing. Estimated cost, $4,500.

Montreal, Que.
A permit for the erection of a hall has been issued to the Trustees of St. James Roman Catholic Church, St. Catherine and St. Denis Streets. Approximate cost, $3,000. Work by day labor.

Rothsay, N.B.
Tenders on the erection of a five-roomed brick school are being received by F. Neil Brodie, Architect, 42 Princess Street, St. John.

Union Bay, B.C.
Tenders on the erection of a two-roomed school will be received until noon, July 17th, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of J. Baird, Government Agent, Cumberland, B. C., George Thomson, Government Agent, Nanaimo, J. Mahone, Government Agent, Vancouver, W. Haggart, Secretary to the School Board, Union Bay, and at the Department.

Whonnock, B.C.
Tenders will be received until noon, July 17th, by J. E. Griffith, Deputy Minister of Public Works, for the erection of a one-roomed addition to the school. Plans and specifications with J. A. Mahoney, Government Agent, Vancouver; F. C. Campbell, Government Agent, New Westminster; J. B. Martyn, Secretary to the School Board, Port Haney, and at the Department, Victoria.

CONTRACTS AWARDED

Beverly, Alta.
Henry Walk, Chaplin Street, is erecting a school, estimated to cost $13,500. Heating, painting, and plastering will be sub-let. Brick veneer construction.

Elmwood, Man.
Work is under way on the erection of an addition to the King Memorial Church, Coburg Street. The general, masonry, carpentry, roofing, plastering, and painting contracts have been let to Worwswick Bros., 123 Hart Avenue, the contract for iron work to the Western Steel & Iron Company, Limited, Chalmers, and for electric work to Price & McDonald.

Montreal, Que.
The contract for the erection of a fire escape at the school on Sherbrooke Street has been let to Bonnell Bros., 341 Guy Street, at $3,610.

Quebec, Que.
The contract for waterproofing the basement of the Customs House has been awarded by the Department of Public Works, Ottawa, to the Standard Paint Company of Canada, 52 Victoria Square, Montreal.

Toronto, Ont.
The Department of Public Works, Ottawa, have let the contract for the installation of interior fittings at Postal Station G to the Berlin Interior Hardwood Company, Limited, 72 Wilmot Street, Berlin.

Westboro, Ont.
The School Board have let the painting contract in connection with the school in course of erection on Euclid Street to Basil T. Thomas.

Business Buildings and Industrial Plants

Brussels, Ont.
John Currie & Son have purchased a site, on which they propose to erect a slaughter house.

Clinton Township, Ont.
C. Hendershot, Beamsville, contemplates extensive alterations and additions to his farm buildings. Brick and frame construction.

Fort William, Ont.
The erection of stores on Victoria Street is contemplated by I. C. Murray, Murray Block. Architect, L. W. Allen, care of owner. Work will be done by day labor, with the exception of heating, which will be sub-let. Approximate cost, $7,000.

Work has been started by day labor on the erection of a drying plant for N. M. Patterson & Company, Limited, Fort William West. Frame construction, concrete foundation, corrugated iron roofing. Approximate cost, $5,000.

Kentville, N.S.
Work has been commenced on the erection of a drug store on Main Street for W. W. Rockwell. Frame and brick construction.

Okanagan Landing, B.C.
The erection of a station, round house and turntable is contemplated by the Canadian Pacific Railway. Divisional Superintendent, J. F. Richardson, Vancouver.

Ottawa, Ont.
Work has been started on the erection of stables for J. Torontow, 27 McGee Street. Frame construction, concrete foundation. Work by day labor.

The Healey Cartage Company, 59 Botelier Street, have had plans drawn for coal sheds, conveyors, etc., estimated to cost $4,000. Frame and ironclad construction, concrete foundation, corrugated iron roofing. Motors will be required.

Work has been started by day labor on the erection of a warehouse for O. Petegorsky, 30 Stewart Street. Estimated cost, $5,000.

An addition to the Davidson Wood Factory on Wellington Street is contemplated by the Davidson Estate. Mill construction, corrugated iron roofing. Woodworking machinery will be required. Manager, L. Henderson, Wellington Street.

The garage in course of erection for Mederic Landreville, Albert Street, is being built by day labor. Material is purchased by owner.

Petrolia, Ont.
Josh Bros., Wonderland Theatre, are about to fit up premises as a moving picture theatre.

Port Dover, Ont.
The erection of a steel pavilion is being considered by Morley Buck.

Stamford Township, Ont.
C. M. Borter, Main Street, Niagara Falls, is preparing plans of a barn for H. D. Symmes, Culp Street, Niagara Falls South.

Toronto, Ont.
Tenders will be received until July 17th by J. C. Forman, City Hall, for alterations to the store building at 756 Broadview Avenue and for the removal of the old building at 754 Broadview Avenue.

The Board of Control have instructed Propery Commissioner D. Chisholm to prepare plans for a barn to be erected at the Men's Industrial Farm. Approximate cost, $25,000.

CONTRACTS AWARDED

Hamilton, Ont.
Work is in progress on alterations to a hotel at Main and Hughson Streets for L. Munroe, Freeman Place. The general, masonry, carpentry, steel and roofing contracts have been let to S. Hamard, Mary Street. Plastering, painting, heating, plumbing and electrical work still to be let. Approximate cost, $4,000.

Farewell & Guest, 167½ King Street E., have let the masonry contract in connection with the theatre which they are building to B. Barnes, 53 Cheener Street.

Ingersoll, Ont.
Work has been started on alterations to the factory of the John Morrow Screw Company. The masonry, steel and roofing contracts have been awarded to Sinclair & Woodhall, 105 Sandford Avenue S., and the carpentry contract to L. J. Beatty, 175 Emerald Street S. Plastering not let.

London, Ont.
Work has been commenced on the erection of a store for A. Hartman & Shabsove, 200 Dundas Street, by the general contractors, R. Parsons & D. Ross, Maitland Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Work is about to start on improvements to business premises for Hubert Dignan, Registrar's office. The masonry contract has been let to Scott Murray, 564 King Street, and the carpentry contract to S. Willis, 765 Talbot Street. Estimated cost, $3,500.

The general contract for the erection of nine stores on Dundas Street E. for J. M. Moore, 478 Waterloo Street, has been let to N. Southern, Renwick Avenne. Smaller trades will be sub-let. Brick construction, felt and gravel roofing. Approximate cost, $10,000. Work has been commenced.

Niagara Falls Centre, Ont.
Work has been started on the erection of a store by Paomeffa Bros., Niagara Falls Centre. The heating contract has been let to O. C. Gray, Queen Street, Niagara Falls. Contract for electrical work not let.

Ottawa, Ont.
In connection with the garage being built for Parkers Dye Works, Limited, 211 Sparks Street, the heating and plumbing contract has been let to J. P. Bland & Company, 775 Bank Street.

In connection with the theatre in course of erection on Queen Street for B. Stapleton, the contract for lathing has been let to A. Desjardins, 555 St. Patrick Street, and for heating and plumbing to A. Gauthier & Company, 307 Dalhousie Street.

St. Thomas, Ont.
Work has been commenced on the erection of an office building for Perry King, 4 Southwick Street. The masonry contract has been let to A. E. Ponsford, 605 Talbot Street, the carpentry contract to E. Reath, 56 Southwick Street, the plastering to I. Stewart, St. Thomas, the contract for painting to E. Dallyn, St. George Street, and for metal work to Ingraham & Davey, 468 Talbot Street.

Welland, Ont.
In connection with the remodelling of a store for A. J. J. Brennan, 7 Main St. E., the carpentry contract has been awarded to J. C. Diffin, Brennan Block, the contract for a store front to the Kawneer Company, Richmond and Yonge Streets, Toronto, and for flooring to B. Timms.

Windsor, Ont.
In connection with alterations to a billiard parlor on Pitt Street for Malcolm McGregor, the contract for roofing, heating and plumbing has been let to Pennington & Brian, 47 Sandwich Street W., the painting contract to T. W. Brooke & Son, 6 Pitt Street W., and the masonry and carpentry contract to the general contractor, R. Westcott, 55 Oak Avenue.

Winnipeg, Man.
In connection with the bakery in course of erection for N. Segal, 510 Selkirk Avenue, the masonry and plastering contracts have been let to Fred Temchuck, Magnus Avenue, and the contract for steel work to the Manitoba Bridge & Iron Works, Logan Avenue W.

The general contract for the erection of stores for W. & J. McBain has been awarded to Fraser & McDonald, 512 Gertrude Avenue. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $7,000.

Residences

Aylmer, Que.
Gabriel Proulx, Main Street, has commenced the erection of a residence, estimated to cost $3,000. Brick veneer construction, concrete foundation, felt and gravel roofing.

Aylmer, Ont.
J. T. Findlay, 386 Talbot Street, St. Thomas, is preparing plans of a residence to be erected here for Oscar Smith, Port Stanley, at an estimated cost of $3,000. Red brick construction, slate roofing.

Plans are being prepared for a bungalow for C. H. White. Architect, J. F. Findlay, 386 Talbot Street, St. Thomas. Stone and brick construction, tile roofing. Estimated cost, $3,500.

Clinton, Ont.
Plans of a residence are being drawn by F. B. Hoffman, Beamsville, for A. L. Whitelaw, Beamsville. Frame construction, concrete foundation, metal roofing. Estimated cost, $3,500.

Grimsby, Ont.
William Schwab is preparing plans of a residence, estimated to cost $3,600. Frame construction, stone foundation, shingle roofing.

Hull, Que.
T. Lacelle, Bourque Avenue, is building a residence by day labor. Brick construction, composition paper roofing. Approximate cost, $4,000.

Kentville, N.S.
Work has been started on the erection of a frame residence on Main Street for J. W. Cross.

Stanley D. Wolfe is building a residence on Main Street. Frame construction.

H. F. Eaton is building a frame residence on Klondyke Street.

Linsdale, Alta.
Plans of a residence have been drawn for E. Harding, by P. M. Clemens, 331 Garry Street, Winnipeg. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

London, Ont.
The erection of two bungalows is being considered by Whit Lancaster, 1 Stanley Street S. Buff brick construction. Estimated cost, $5,000.

Milton, Ont.
The tenders received for the erection of a jailer's residence for the County of Halton were unsatisfactory. New tenders will be called when the plans are completed. Architects, G. M. Molesworth and G. M. West, 2 College Street, Toronto.

Montreal, Que.
Work has been started by Henry Heider, 369 Rivard Street, on the erection of three residences, estimated to cost $3,000.

O. Lafortune, 325 Notre Dame de Grace Street, is building a residence on Wilson Street, estimated to cost $3,500.

Ottawa, Ont.
The erection of a residence on Gilmour Street is being considered by W. Ellard, 77 Cambridge Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $3,500.

J. R. Rady, 428 Lisgar Street, has plans drawn for a residence, estimated to cost $6,500. Brick veneer construction, brick foundation, shingle roofing.

W. E. Noffke, Architect, Plaza Building, Rideau Street, is preparing plans for alterations to apartments on Slater Street for the H. N. Bate Realty Compan, Canal Street.

Quebec, Que.
Work has been started on the erection of a residence by T. Martin, 53 Sacre-Coeur Avenue. Work by day labor. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

Work has been started on the erection of a residence on Canardiere Street by J. Carmichael, Notre Dame des Laurentides Street. Frame and brick construction, metal and asbestos roofing. Estimated cost, $6,000.

Roderick, Sask.
Plans of a residence have been drawn for W. A. Duncan by P. M. Clemens, 331 Garry Street, Winnipeg. Frame construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

Toronto, Ont.
R. J. Marshall, 60 Rosemount Street, is building a residence at 9 Glenholme Avenue, estimated to cost $3,500. Brick construction, shingle, felt and gravel roofing.

T. J. Allen, 48 Oakmound Road, has commenced the erection of a pair of residences at 66-68 Boon Avenue, estimated to cost $3,600. Smaller trades will be let. Brick construction.

Work has been started by W. Williams, 33 Cloverdale Road, on the erection of a pair of residences at Morrison and Day Avenues. Brick construction. Estimated cost, $4,000.

Tenders on the electrical work required in the erection of a residence are being received by J. J. Matheson, 1279 Dundas Street.

A residence is being built at Beach and Balsam Avenues for R. H. King, 415 Indian Road. Tenders on smaller trades are being received by the owner. Approximate cost, $3,500.

Tenders on electric wiring for three houses are being received by J. Guinane, 9 King Street W.

Uxbridge, Ont.
T. R. Ferguson, Brock Street, is receiving tenders on all trades excepting carpentry required in the erection of a residence, estimated to cost $6,000. Plans and specifications with Mr. Ferguson.

CONTRACTS AWARDED

Bowmanville, Ont.
The contract for the erection of a parsonage for the Methodist Church has been let to Gay Bros., Limited, Courtice Street.

Bridgeburg, Ont.
Work has been started on the erection of a residence by J. C. Purvis. The masonry contract has been let to Albert Nie, Fort Erie. Estimated cost, $3,500.

Chatham, Ont.
James E. Gray, 37 Grand Avenue, has let the general contract for the erection of a residence to Frank Sparks, Sandys Street, and the plumbing contract to J. W. Draper, 4 Fifth Street. Brick construction, shingle roofing. Approximate cost, $3,500.

Grimsby, Ont.
The general contract for the erection of a residence on Fairview Avenue for J. Harrison has been let to D. Marsh & Son. Frame and concrete construction, shingle roofing. Approximate cost, $4,000.

Hagersville, Ont.
J. W. Seymour has let the masonry

contract for the erection of a residence to E. Hannah, and the carpentry contract to G. Smith.

Halifax, N.S.

Work has been started on the erection of a residence for I. S. Roper. The contract for heating and plumbing has been let to G. Perrier, 35 Granville Street, and for electrical work to Farquhar & Company, Limited, 163 Lower Water Street.

Hamilton, Ont.

E. W. Vivian, 408 Barton Street E., has let the general, masonry, carpentry, steel and roofing contracts for the erection of a residence to F. Babbidge, 688 Concession Street. Contracts for plastering, painting, heating, plumbing, and electrical work not yet awarded. Estimated cost, $4,000.

London, Ont.

Dodd & Son and Scott and Murray, 448 King Street, have commenced the erection of a residence for A. Fraser, 7 Horn Street. Brick construction, concrete foundation, slate roofing. Approximate cost, $4,500.

Maisonneuve, Que.

In connection wit the residence being erected by H. Bernier, 758 Adam Street, the contract for tile work has been let to Calkins-Leete, Limited, 1013 St. Catherine Street W., the plastering contract to J. Perron, 279 Moreau Street, the heating and plumbing to G. Lamoth, 190 LaSalle Avenue, and the contract for electrical work to Trudeau & Belleau, 273 Valois Street. Painting will be done by owner.

Ottawa, Ont.

The contract for the erection of a residence for Harry Morrison, 139 Stewart Street, has been let to Bower Bros., 133 Hopewell Street. Stone foundation, brick construction, shingle roofing. Approximate cost, $4,500.

The general contract for alterations and additions to the residence of J. A. D. Holbrook, 25 Cliff Street, has been awarded to S. F. Smith, 448 McLeod Street. Approximate cost, $7,000. Brick construction, stone foundation, shingle roofing.

In connection with the residence being built on Irving Stret by W. C. Leech, 140 Spadina Street, the plastering contract has been let to T. H. Patterson, 70 Rosedale Street, the contract for heating and plumbing to Slater & Nicholson, Kent and Slater Streets, and for electrical work to C. Presby, 138 Irving Street.

The Oakland Company have let the following contracts in connection with the erection of a residence on Bellwood Street:—masonry, B. Dougherty, 16 Cayuga Street; carpentry; W. Fryer, 5 Glen Avenue; plastering, T. Patterson, 70 Rosedale Street; heating and plumbing, J. P. Bland & Company, 775 Bank Street; electrical work, Dominion Electric Company, 417 Sparks Street.

A residence is being built for R. B. McDougall by George Eaman & Son, Isabella Street, at an estimated cost of $9,000. The contract for heating and plumbing has been let to McKinley & Northwood, 56 Rideau Street, and for electrical work to Davis Electric Company, 21 Echo Drive.

In connection with the apartments in course of erection on Metcalfe Street for J. A. MacDonald, 25 Thornton Street, the contract for plumbing has been let to M. M. O'Connell, 212 Gloucester Street, and for electrical work to Marchand & Donnelly, Sparks Street.

Quebec, Que.

The contract for carpentry in connection with the residence in course of erection for David Lacombe, 51 St. Malo Street, has been let to P. Trudel, 106 Scott Street, and for roofing to J. Maranda, 2 Grenier Street. Painting by owner.

In connection with the residence being built for G. Chamberland, 79 Napoleon Street, the carpentry contract has been let to Cote & Frere, Limoilou. Painting, heating, plumbing, and electric work will be done by the owner, and masonry by the general contractors, Poulin & Marcoux.

A. Guilmet, 204 St. Therese Street, has let the roofing, painting, plumbing, and electric contracts in connection with the erection of his residence to E. Lelievre, 1 Ste. Marguerite Street, and the plastering contract to Freres Proteau, 197½ Notre Dame des Anges Street. Painting by owner.

The general, masonry and carpentry contracts for the erection of a residence for W. Lapointe, 226 Marie De L'Incarnation Street, have been let to Bertrand & Lapointe, 1113 St. Valier Street. Estimated cost, $5,000.

In connection with the residence in course of erection for E. Thivierge, 94 St. Ambroise Street, the roofing, heating plumbing, and electric contracts have been let to E. Gauvin, 116 Fourth Street, Limoilou. Masonry and plastering will be done by the general contractor, A. Deslauriers, 100 St. Francois Street.

In connection with the residence in course of erection for J. Poulin, 160 Hermine Street, the roofing contract has been awarded to E. Falardeau, Dorchester Street, and the heating, plumbing, and electric contracts to F. Gingras, 34 St. Augustin Street. Plastering will be done by the general contractor and painting by owner.

Sudbury, Ont.

Work has been started on the erection of a residence for C. R. Smith. Practically the whole of the work will be done by the Atlas Building Company. The contract for electrical work has been let to the Cochrane Hardware Company, Cedar and Durham Streets. Approximately cost, $3,000.

Toronto, Ont.

A residence is being erected at 14 Wilfred Avenue for W. Wilkie, 10 Wilfred Avenue. The general and carpentry contracts have been let to H. W. Nix, Canada Life Building. Smaller trades will be sub-let by the general contractor. Approximate cost, $4,000.

A residence is being built at 13 Glenholme Avenue by the W. R. McGiffin Company, 1504 King Street W., at an estimated cost of $4,500. Smaller trades will be sub-let. Owner's name withheld.

Work has been commenced by H. C. Long, 901 Traders Bank Building, on the erection of a residence at 130 Keewatin Avenue, estimated to cost $5,000. The contract for masonry work has been let to Elliott & Brown, 132 Ellswirth Avenue. Smaller trades will be sub-let.

In connection with the residence being erected at 78 Glencairn Avenue by G. T. Death, 244 Sheldrake Avenue, the plastering contract has been let to F. Clark, 203 Bedford Park Avenue, the contract for painting to D. Forest, 165 Sherwood Avenue and for plumbing to A. Earl, 774 Gladstone Avenue.

In connection with the residence being erected on Conduit Street by S. B. Green, 650 Annette Street, the plumbing contract has been let to J. G. Jackson, 142 Quebec Avenue, and the contract for heating to C. C. Ormsby, 133 Quebec Avenue. Plastering, painting, and electrical work by day labor.

The plastering contract in connection with the residence in course of erection for J. J. Matheson, 1279 Dundas Street, has been let to W. A. Fenn, 203 Perth Avenue, and the contract for the installation of a special Spencer heater to McKenzie & McNaughton.

A. Hussey, 133 Sellers Street, has commenced the erection of a pair of residences at Sellers and Morrison Avenues, estimated to cost $4,000. The contract for heating has been let to G. Davis, 151 Boon Avenue. Plumbing, electrical work, and plastering will be let.

In connection with the residence being erected on Hastings Avenue by Donenfield Bros., 322 Clinton Street, the plastering contract has been let to A. J. Bottrell, 542 Palmerston Boulevard, and the heating contract to Welsh & Son, 304 Queen Street W.

The general and carpentry contracts for the erection of a residence on Melgund Road have been let to N. Hicks, 612 Delaware Avenue, and work is under way. Brick construction, shingle roofing. Approximate cost, $9,000. Owner's name withheld.

Welland, Ont.

The general contract for the erection of a residence for R. H. Dawdy has been let to Learn & Mann. Brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Westboro, Ont.

In connection with the residence being built on Golden Avenue by R. E. Ralphs the contract for electrical work has been let to H. L. Allan, 377 Somerset Street.

Westmount, Que.

Work is under way on the erection of a residence on Carlton Avenue for T. A. Sommerville, 49 Windsor Avenue. General contractors, B. M. Cape & Company, Limited, 10 Cathcart Street. Stone and brick construction, slate roofing. Approximate cost, $12,000.

In connection with the erection of a residence at Redfern and Westmount Avenues for J. Quinlan, 4412 St. Catherine Street, Montreal, the contract for roofing has been let to Douglas Bros., 19 St. Maurice Street, and for heating and plumbing to T. O'Connell, 183 Ottawa Street.

Winnipeg, Man.

Work has been started on the erection of two residences for R. McGreevy, 404 McGreevy Building, Portage Avenue, by L. LeDue, 533 Sherbrooke Street. Frame construction, shingle roofing. Approximate cost, $5,400.

Power Plants, Electricity and Telephones

Fredericton, N.B.
The installation of a fire alarm system, at a cost of about $1,200, is being considered by the City Council. Chairman of the Fire Committee, T. S. Wilkinson.

Penticton, B.C.
A by-law providing for extensions to the electric lighting system has been passed, and work will start shortly. Estimated cost, $6,000. Clerk, G. S. Clark.

The Pas, Man.
The installation of a light and power system at a cost of $50,000 is being considered by the Town Council. Clerk, H. H. Elliott.

CONTRACTS AWARDED

Montreal, Que.
The contract for the installation of an electrical system at the Filtration Plant has been let by the Board of Commissioners to G. M. Gest, Power Building, at $6,275.

Rocanville, Sask.
The contract for the construction of a telephone system for the Cambridge Rural Telephone Company, Limited, has been let to Brown & McKenzie, Regina,, at $3,400.

Fires

Clarkstown, Ont.
The residence of J. B. Lajoie, Cedar Street, has been destroyed by fire. Loss, $3,000, partially covered by insurance.

Niagara Falls South, Ont.
Fire has practically destroyed a dairy belonging to G.Badger, Ferry Street. Loss, about $2,500.

Smithville, Ont.
Robert E. Book's sawmill has been destroyed by fire. Loss, $5,000.

Miscellaneous

Belleville, Ont.
Quotations on the supply of cast iron pipe, chiefly 6-inch, are being received by City Engineer J. W. Evans, or the Clerk, J. W. Holmes.

Nelson, B.C.
The Town Council propose to install an incinerator at an early date. Mayor, J. J. Malone.

Tavistock, Ont.
The Town Council have instructed the Fire Committee to obtain estimates of the cost of approximately 500 feet of hose, with nozzles, etc. Chairman, H. N. Roth.

Toronto, Ont.
W. C. Collett, 7 St. Mary Street, is receiving catalogues and information with regard to cold storage and refrigeration machinery.

CONTRACTS AWARDED

Buctouche Beach, N.B.
A contract for dredging has been let by the Department of Public Works, Ottawa, to F. Michand, Buctouche.

Charlottetown, P.E.I.
The Department of Public Works, Ottawa, have let the contract for dredging at Rocky Point to W. G. W. Bertram, 117 Stair Building, Toronto.

Ottawa, Ont.
The City Council have awarded contracts for the supply of 500 feet of fire hose to each of the following firms:—Canadian Consolidated Rubber Company, 317 Bank Street Gutta Percha Company, Ottawa Dunlop Tyre & Rubber Company, 72 O'Connor Street Goodyear Tyre & Ruber Company, 184 Albert Street.

Windsor, Ont.
The City Council have let the contract for the supply of pig lead to J. T. Wing Company, 61 Sandwich StreetE., at $6.95 per ton, and for the supply of stop boxes, brass taps, etc., to the Miller Manufacturing Company, Sarnia.

Winnipeg, Man.
The general contract for the construction of five balconies for the Board of Control has been awarded to J. A. Fraser, 426 Glasgow Avenue.

When the steel passenger car was introduced into American railway systems, the immediate object was to diminish loss of life in collisions. The replacement of equipment will have cost the railways approximately $650,000,000 and incidentally has considerably increased the cost of operations, as heavier locomotives are required to haul the trains. The President of the Chicago & Great Western Railway says:—

"These heavier locomotives, with heavy steel equipment behind them, running at high speed, in case of accident become more destructive than any of the trains in the days of the wooden car; in fact, we have records of the complete destruction of steel sleeping cars in rear-end collisions, and it would be impossible to build a steel car that would resist the shock of a rear-end collision from a train running fifty or sixty miles an hour."

The substitution of steel for wooden cars has also dealt a serious blow to the lumber industries of the Pacific North-West and has increased the danger of forest fires. Car material provides a market for the common grades of lumber and the elimination of this market has meant a large proportion of waste left in the woods. Waste left in the woods means increased forest fires hazard, and greater difficulty in clearing land for agricultural development, so that in the opinion of the Pacific Coast lumberman the cost to Uncle Sam has been much more than $650,000,000—indeed, it would be more like a billion dollars—all of which has ultimately to be paid by the public.

Rough comparative costs for surface, elevated and subway lines were given recently by Prof. George F. Swain in a discussion of rapid-transit problems in cities before the Engineers' Society of Western Pennsylvania. Single-track surface line, exclusive of equipment, costs about $50,000, while the cost of a single-track elevated line, exclusive of equipment, is about $250,000. Subway costs are so variable that no accurate figures can be given; $1,000,000 per mile for single-track, exclusive of equipment and damages, or $2,000,000 per mile for double-track may, he thinks, be as fair a single figure as can be given. The figure may, however, be very misleading, he points out. The Washington Street subway in Boston, which he thinks is probably the most expensive subway in the world per mile, cost $6,916,000 per mile, including property takings, or $5,103,000 excluding them. For a single exit and entrance stairway in private property $215,000 was paid, and for another entrance to the same station an entire building was bought at a cost of $630,000, and subsequently sold for $587,500.

Within a short time the gypsum works at Quarry St. Ann's will be one of the biggest and busiest of Cape Breton concerns says the N. S. Herald. At present preparations are being perfected for the installation of a new power house, with dynamoes, air compressor, etc., which will be used in connection with the plant, and in a short time the company expect to turn out at least a million tons of gypsum a year. To-day the force of men employed amounts to about one hundred.

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Business Managers for Councils

WE had thought that the sphere of city managers, efficiency experts, and other specialists, was essentially American, but from what we can learn there would appear to be the possibility of a field opening up across the water. At any rate, we find one of our English contemporaries suggesting that the affairs of the county councils be administered or supervised by a "Business Manager." It is argued that in large commercial undertakings there is always an official of sufficient training and breadth of experience to detect, almost by intuition, any leakage, and advise means whereby the utmost efficiency may be obtained at the least possible expenditure. Why not a business manager for a county council? Councils, we are told, are but the parallel of boards of directors, controlling vast concerns in which the shareholders are represented by the ratepayers. It is suggested that at their head there should be a trained and experienced business man to superintend all departments, to master every detail, examine each financial proposal, and check each transaction. Our contemporary continues:

"The regular staff would soon feel that they also were concerned in the task of making the business pay, and would loyally assist in checking waste. It is by such means that our gigantic commercial businesses are made to pay big dividends, and the salary of such an official would soon be paid out of the money saved. Moreover, the effects of this system of thrift would be cumulative. The presence of this business adviser would curb the competitive instincts of councillors and strengthen the hands of the other officials, many of whom are forced by existing circumstances into extravagances which their private judgment condemns."

The suggestion is well enough in theory, and the observations are very beautiful in their way. To the Canadian mind there is something very attractive in the picture of a staff all working together to make the city's business pay, and loyally assisting in checking waste, but these attractive propositions do not always work out just right. In the first place, where is one to find a man sufficiently versatile and able to control all the various activities of a town, city, or county council? In all conscience, it is hard enough for a technical man to please the public in his capacity as city engineer, when he can take refuge in the theories and formulas appertaining to his work. The lot of the business manager, were a man of sufficient competence to be found, would not be an enviable one.

Then, surely, it would be difficult to define the beginning and the ending of the functions of such an official. Again, the engineering activities of his Board would be one of the most important in his province, and to detect "leakages" in the City Engineer's department "almost by intuition" he would have to possess technical training of no mean calibre.

As to "curbing the competitive instincts of councils," we cannot believe that under the existing system, whereby men of such low attainment are elected to administrative office, this could be accomplished by any adviser—business or spiritual.

If we were to offer any advice to our friends across the water, who would appear to be influenced by the developments of recent years in the United States, we might compress it into one word—the word that sums up Mr. Punch's sentiments in respect to matrimony—"don't." The simpler the system of administration, the better—and in most cases the older systems are the simpler, because they were devised at a time when business conditions were not so complex, and when men talked less and thought more, perhaps.

Innovations of this kind which have been made in the United States have not been attended by any remarkable degree of success, and with all due respect to the characteristic enterprise of the adherents of Uncle Sam, business administration across the border generally is not such as to provide the material for a volume of correspondence, with all the specialized departments which have come into being.

Efficient administration rests with the public: they decide at the polls how their affairs are to be carried out. If we can raise the standard of admission to our councils it will not be necessary to cast about for new offices, to employ experts to detect "leakages," and check inefficiency.

We are sorry to find our English friends talking of business managers for their councils. It is an unhealthy sign.

The War—A Forecast and a Warning

(From The London Builder)

THOUGH it may be long before the war is over, we have confidence enough to believe it can only have one outcome, and, though any forecast of its consequences may not be fully borne out by results, yet it may be useful to consider the changes which are likely to be effected and their result on the industry of building.

The great family of European states, with the exception of Germany and Austria, or possibly Germany alone, ardently desired peace last year, and did all that could be done to secure it. France, though ever conscious of the amputation which resulted from the war of '70, would never have drawn the sword in aggression to recover her lost provinces, while neither England nor Russia had anything to gain from war commensurate with the certain loss of life and treasure involved in prosecuting it. The Allies drew the sword unwillingly, only to find themselves confronted with an organized force of aggression such as the world has never seen, and to realize that the motto "Duetschland uber alles" represented not a legend but the passionate conviction of a whole people. But now that the issue has been forced peace can only come through the loss by Germany of much that has made her in the past the most powerful single state in Europe, and this loss will cripple her and put an end to the commercial supremacy which she has gained during forty years of enormous commercial expansion.

The direct outcome of this state must be an increase in the manufacturing and commercial developments of other countries, notably England, France, and America, and the increase, which will be not only relative but actual, will bring other consequences in its train.

There can be little doubt that we shall see building developments at first checked by the dislocation caused by the war and the resulting dearness of money, but ultimately gathering force and resulting in a period of increased production and manufacturing activity. We may, therefore, enter on a second phase of industrial development, which, owing to our Factory Acts and other legislation, will not be detrimental to the health and physique of the people like that of the earlier part of last century.

To an extent unknown at any previous period capital is likely to be invested freely where it will earn the best dividends, for there will be little likelihood for a long time of war and the rumours of war which so often check the free flow of capital.

The conditions which have made for cheap production in Germany will, to a large extent, have vanished, since the markets of the world are not likely to be as freely open to her as in the past, while her capital will have been greatly dissipated in war. There is naturally another side of the question, for the partial destruction of Germany as a seller will destroy her potentiality as a buyer; but this will injure manufacturing interests in other countries less, because she has always been a large buyer of raw and partially manufactured goods and a large seller of highly-finished products.

While the expenditure of capital on war by this country and the Allied powers will prove an immense drain, the interest of which must for long be a burden, there will be counterbalancing advantages which will, as time goes on, make themselves felt. The cost of preparation for war is largely occasioned by its likelihood or imminence. The German naval programmes for many years have determined our own; the German army increases have been counterbalanced by increases in the armed forces of France and Russia. So that, although the abolition of force is a chimerical dream, we may look forward to decreased expenditure in preparation for war when the European boundaries are remodelled in accordance with racial lines. More than this, the nations who have faced a common danger will be bound by ties which will tend to eliminate the artificial barriers which have operated in the direction of hampering trade. The development of the Balkan States and the new solidarity given to the Empire will operate in favour of producing new markets and encouraging commerce.

Housing conditions will naturally be affected by the loss of a certain percentage of the population; since housing is urgently required not so much because it is inadequate in amount, but because the existing accommodation does not meet the hygienic standards of the time, and so the pressing need for it will remain, and if the private speculator has been frightened by the recent land legislation it will still have to be undertaken by municipal and county authorities. The present coalition of parties may perhaps bear fruit in the future settlement of some controversial points on broader lines, and it may be possible that a modus vivendi may yet be found on the question of land which will remove the present feeling of insecurity in it as an investment.

Less money will be spent for some time on municipal schemes other than those which are urgently required, as the average ratepayer will feel the greater necessity of keeping down rates because of the raised standard of national taxation.

The wealthy will, as they have done in the past, spend money on building, and the advisability of renting or owning houses will not be affected, since we are forced to rent or build under any circumstances, but there may be for some time a larger demand for smaller houses owing to the necessity of many to economize.

Summing up, we should say that there will be an increase of purely commercial and utilitarian building, a temporary decrease of municipal building, other than that of a purely utilitarian character, and a normal amount of private work of a domestic character. When we couple with this the fact that a great deal of work, the execution of which has been delayed owing to the war, will be put in hand, we should be safe in predicting a period of great building activity within a short period of the conclusion of peace.

We might add that as in the opinion of most experts there is likely to be an increase in the cost of building after the war, it would probably be a prudent course for those who are able to do so to build now rather than later. The industry will also be helped if those bodies and private individuals who know they will have to build in the near future would make all preparations for doing so by having professional work done now. By so doing they will be saving time and also performing a public service, as, if everything is left undone till the war is over, it will tend to promote a period of unemployment after the return of our armed forces, and labour will have to wait until these preparations are made, while there is now ample time to get all in readiness.

There is one factor which may militate against this result, and, in fact, militate against a great trade revival and throw the commercial advantages accruing from the cessation of war into the lap of our rivals—we refer to the possibility of great labour troubles. We knew a boy who was more noted for bodily than mental vigour, and who, when he found a gold watch would not go, proceeded to wash it with a nail-brush, and the process of striking has always seemed to us as reasonable a remedy for labour disputes and as creditable to both employers and employed. Obviously labour and capital have something to divide, which is the profit on a transaction, and it should be possible to agree as to the division without resort to strikes; and the only way to effect this is for capital and labour in each industry to settle on some kind of a sliding scale, and last but not least for labour to honour its cheques.

For the building trades or any other industries to create labour troubles when the revival comes is to play into the hands of our rivals and check commercial prosperity.

Without being Socialists we can sympathize with the efforts of those who are to obtain for the people a larger share of the good things of this life; but Socialism, if it ever comes, will not be brought about by a revolution, but by the gradual transfer of profits to the labour side of the account, the capitalist becoming the titular instead of the real ruler of the world of enterprise. Education and permeation are necessary if this is to come about, and the strengthening of the weakest links of the human chain, not the tearing apart of the strongest ones. In a world of free trade an undue advance of wages in Europe will throw men out of employment here and transfer industries to the more primitive countries of the East, to the workers' detriment. The cotton looms of India may in the future convert free trade Manchester into a protectionist centre, or, on the other hand, transfer an industry from West to East, unless the Asiatic worker has as high a standard of wages and material comforts as our own. If the gospel of Socialism is right it will prevail in the end, but undue insistence on its rights in any circumscribed area will simply transfer trade to more primitive communities. Labour will always gain an advance in times of great prosperity that it will never wholly lose in the slumps which follow, and in its own interest should do nothing to check that prosperity which is automatically working in its favour and giving it year by year greater powers and influence in the counsels of the State.

Another factor which may prove to be important is the fact that many of those taken from sedentary occupations and now under arms will be disinclined to take up their former employment. This may result in greater emigration to the dominions beyond the seas, and a further strengthening of the ties which bind us to those of our race who are daily giving us proof that the Empire is one in spirit and that the strongest of states may rest on a foundation of the freest of institutions.

Engineering Prospects and Opportunities

By F. H. Fay

THE future of engineering is bright. Opportunities are expanding. The world is coming to expect and to demand a higher standard of the engineer and of engineering. Engineering is the oldest of all professions, and dates from the earliest and most elementary civilization; but it is only within comparatively recent years that it has become recognized as a distinct profession, and we must still look to the future for that full recognition to which we engineers believe the profession is entitled.

In every field of activity the world is coming more and more to depend and rely upon engineers. But to meet these demands, engineers themselves must grow and become broader men. The successful engineer of to-day and of to-morrow cannot be like the engineer of yesterday, who too often would "retire into the technical recesses of his professional work and content himself with being the servant of other men." The engineer of to-day should be a broad-gauge man, aggressive, alert, in touch with public questions outside his own narrow field, and a leader—not a follower—of men. It is upon the development of the qualities in engineers themselves that the whole future success of the profession depends.

The best technical school training for an engineer is one which gives a thorough grounding in the fundamental subjects of science and engineering without frills and specialties. In response to popular demand, there has been in most of our technical schools during the past few years a tendency to too high a degree of specialization. Fortunately, a reaction is setting in, and in the best technical schools to-day courses are being rearranged so as to give the student a more thorough training in science and the general principles of engineering, with less specialization.

There is one quality of highest importance to the success of the young engineer which cannot be taught in schools and which he must gain for himself, and that is, the ability to properly meet and mingle with his fellow-men. In other words, he should be what is popularly known as a "mixer," and failure in this direction is responsible for the lack of, or limited, success, of many an engineer who has the other requisites, and who but for this lack would undoubtedly achieve a far higher position.

The engineer should be a manager, and should

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[1] Extract from the Presidential address before the Boston Society of Civil Engineers at the recent annual meeting.

give orders to others who can do the work under his direction as well as he himself could do it with the situation reversed. It should not be considered unprofessional for an engineer to be a capitalist ,and, when he takes his proper place as promoter and organizer and shares in the profits of engineering enterprises, he will no longer be taunted with the saying that "an engineer is only good to spend other people's money." It is by acquiring individual strength that the engineer can give strength to the profession. It is well known that engineers of admitted proficiency often have to work under the direction of men who are unfitted by education and experience to direct engineering work. This is because the engineer is a workman, while the other party belongs to the class of "managers." The engineer has not reached his proper rank until he can hold the position of manager, as well as that of a designer and supervisor of work.

Engineers themselves are frequently responsible for the low estimate which the public places upon the value of engineering services. Chief engineers of Corporations and Public Boards too often make the mistake of hiring engineering assistants at the lowest possible wage, under the false impression that by such rigid economy they are enhancing their own value in the minds of their employers.

Such practices do grave injury to the whole profession and cheapen it in the estimation of the public. Furthermore, they tend to react to the disadvantage even of the chief engineer, for his employers will reason that if the rank and file of engineers can be hired so cheaply, engineers as a whole are a cheap lot, and high salaries are not necessary in any grade, even that of the chief engineer himself. The chief engineer who pays a fair wage, taking account of the time and money which the young engineer has spent in securing his education and training (his working capital), will not only secure better, more loyal, and more efficient service, but will help to raise the standard of the whole profession.

Modern Tendencies in Railway Track Construction

Specially contributed by J. L. Busfield, B. Sc.

IN reviewing modern railway track construction it is natural to make a comparison with track construction as it was, say, twenty or thirty years ago. The first impression is that there has been remarkably little change, as the rails are of essentially similar shape, are fastened to the ties in the same way, and so on. But a closer study of the question reveals the fact that there have been very considerable changes, although they are of such a nature that they are not at once apparent. It was only in the early eighties that open hearth steel was used generally for the rails; previous to this date wrought iron was commonly used. The rails were made by passing a number of strips of iron through rolls at white heat welding them together. A great deal of trouble was experienced with this method due to the rails splitting along the line of the laminations. At this time a rail section of about 56 or 60 lbs. to a yard was commonly used, and the maximum size reached was 70 lbs. to a yard. These rails conformed approximately to the shape of rail now used. Thirty years ago a split switch was not used to any extent at all, the now abandoned stub switch being in universal use. Spring frogs were used occasionally, but in a very crude form compared with present-day practice.

Ballast

A large proportion of railroad track is ballasted with whatever material, more or less suitable, can be obtained readily in the immediate neighborhood. In this way such materials as dirt, cinders, burnt clay, furnace slag, and gravel are commonly used. Of these gravel is the best and most popular material, and is readily obtainable in natural deposits in all parts of

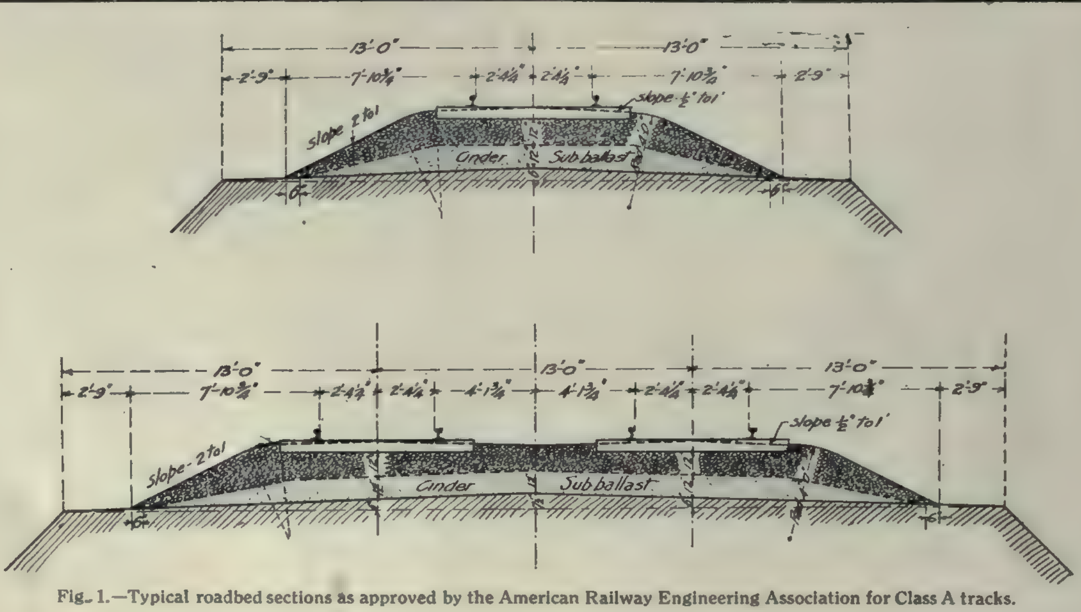

Fig. 1.—Typical roadbed sections as approved by the American Railway Engineering Association for Class A tracks.

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* Assistant Engineer, Montreal Tunnel and Terminal Construction.

the country. An improvement of the natural material is frequently made at no very great expense by screening and washing, removing such objectionable features as fine sand, dirt, dust, marl, lime, etc. A great objection to gravel ballast is that it is apt to be dirty, and it does not shed water very freely—with the result that in freezing weather it expands, and generally upsets the line and surface of the track.

Where conditions necessitate a first-class track regardless of the initial expense, crushed rock (broken stone) ballast is the only material that really fulfils all the requirements of a good ballast. Considering that different rocks have very variable quantities, care has to be taken to select a good kind of rock, suitable for the purpose, and, bearing in mind that rock ballast will cost from $3,000 to $6,000 for every mile of double track, it will be seen that a certain amount of study is warranted to ensure the selection of a rock that will be suitable. It is impossible to name any particular variety of rock as being more suitable than others, because all rocks vary in their properties in different localities; for example, the commonest rock used for ballast is limestone, but there are some kinds of limestone most unsuitable for ballast.

In order to obtain the best results, rock for ballast should have the following properties:—First: It should break with a sharp angular fracture and not into thin shaly pieces, so that the sharp points can grip the ties and prevent their displacement, and at the same time provide interstices between adjacent stones, enabling drainage water to percolate freely. Second: The rock should have a high specific gravity in order to minimize any tendency to displacement. Third: The rock should be both hard and tough—the former, to resist grinding action and the formation of dust, which would block the interstices between the stones—and the latter, to resist fracture by impact. Fourth: Its water absorption factor should be low, as a rock that will absorb much water rapidly becomes disintegrated under the action of the weather. Fifth: Its cementing value should be low; otherwise the fine grindings will bind the whole roadbed into such a solid mass that detrimental results will be obtained in the line and surface of the track.

It has not been the general practice in the past for railways to prepare specifications covering all these points, but in some cases a statement is made that stone for ballast must withstand a certain minimum crushing load (usually from about 10,000 to 12,000 lbs.), and also that the rock shall be durable enough to withstand climatic effects, hard enough to prevent pulverizing under the action of tools or traffic, and that it shall break with an angular fracture when crushed. Sizes are usually specified, but these vary considerably on different roads. The U. S. Department of Agriculture have established tests and standards covering all the features mentioned above, but the figures obtained have not yet been adopted to any extent by the railways.

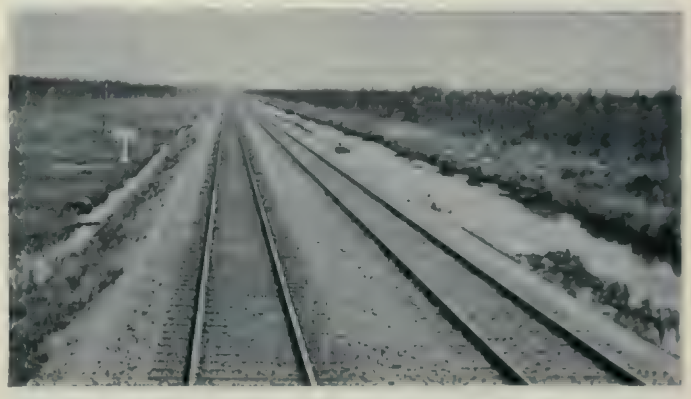


Fig. 2.—A piece of double track in which Carnegie steel ties are used.

A recent innovation in roadbed construction is the use of a sub-ballast, which provides an additional drainage medium between the ballast and the roadbed. It should be formed of sand, stone screenings, cinders, granulated slag, or any convenient material that will drain readily and at the same time fulfil the functions of a cushion. Typical roadbed sections as

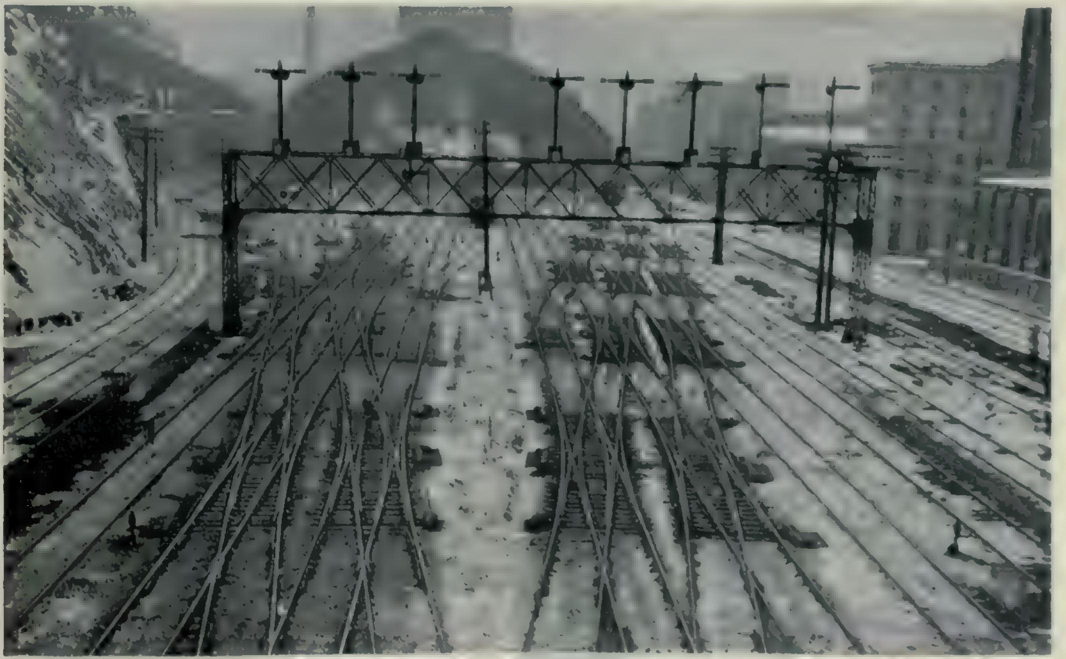


Fig. 3. -A typical instance of the use of slip switch crossings.

approved by the American Railway Engineering Association for Class A tracks are shown in Fig. 1.

Cross-ties

With increased wheel loads and higher train speeds, the cross-tie has to be particularly well selected in order to withstand the strains placed upon it. Originally the railway tie was taken from the most available supply, whereas to-day it is common practice in Canadian railways to import long-leaf yellow pine ties from as far as the Southern States. The desirable properties of the ideal wood for a cross-tie are heaviness, hardness, strength, toughness, elasticity, and durability, and there are very few woods which fill all these requirements. The woods most nearly forming an ideal tie are long-leaf yellow pine, white oak, and eucalyptus, but a very large number of other woods are in general use. It frequently happens that when a tie is particularly durable it is apt to be weak. This applies in the case of a cedar tie. Cedar is very durable, but it is readily damaged by rail cutting. This difficulty, however, can be overcome by the use of tie-plates which spread the rail load over a large area of the tie. Because of the growing scarcity of trees suitable for supplying ties, a number of railways in the States have inaugurated their own plantations for supplying ties. In these instances the eucalyptus, locust, and catalpa trees have been most favored on account of their rapid growth. They all make first-class ties.

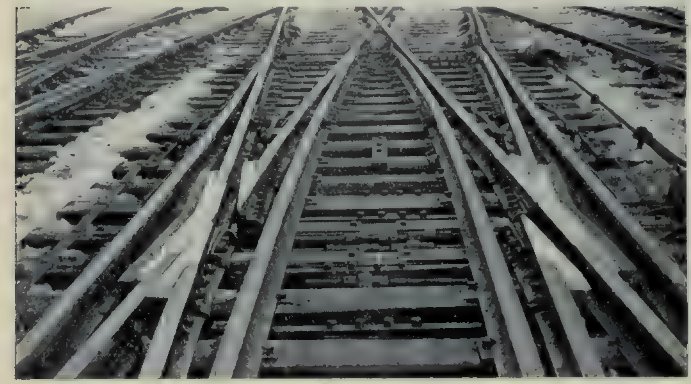


Fig. 4.—A slip switch heavily strengthened with manganese steel.

Preservation of ties by chemical treatment is steadily growing in favor, and a great many woods unsuitable on account of their short life in a natural condition become ideal ties when treated in such a way as to double their life. The most popular method of treatment is some form or other of the creosote process, but there are a large number of adherents to the zinc chloride and other processes using the two chemicals as a preservative medium.

On account of the growing cost of wooden ties, with the added cost of treatment and the use of tie-plates, the use of the steel ties is becoming quite a standard practice. There are two forms in common use: (1) the inverted channel section; (2) the I-beam section. The first of these is a standard on the National Railways of Mexico, and has proved very successful, but is far outnumbered in point of use by the Carnegie steel tie. This latter is a steel I-beam of special section rolled in different weights and sizes to suit varying conditions of traffic. The rails are fastened to the tie by means of a steel clip and a small bolt, four of which are used to a tie. Where electric track circuits are in use some insulating medium is placed between the rail and the tie. The weights most commonly used are 20 and 28 lbs. to a foot, and these ties are 5½ ins. and 6½ ins. high, with bases 8 ins. and 10 ins. wide, and tops 4½ ins. and 5 ins. wide respectively. The ties are usually cut 8 ft. 6 ins. long, and are spaced 18 to 20 ties to a 33-ft. rail. There is no question but that they form a very satisfactory tie, and their use depends more on financial consideration than on their efficiency, although quite a favorable comparison can be made between the steel tie and a first-class oak tie, creosoted and fitted with screw spike and tie-plates, provided the life of each type is taken into consideration. Figure 2 illustrates a piece of double track where Carnegie steel ties are in use, and the popularity of this form of tie is proved by the fact that there are now in use upwards of 5,000,000 steel ties.

A certain amount of experimenting has been done with concrete ties, but so far there is no particular type which has been used to any extent, and they have not advanced beyond the experimental stage.

Track Fastenings

With the growing cost of ties every effort is made to increase the life of a tie to the maximum amount possible. It has been found that the life of a tie is to a great extent limited by its inability to resist the mechanical wear caused by rail and spike cutting, so that as it becomes more common to treat ties with a preservative it is more essential that they should be protected from mechanical wear. To this end tie-plates and screw spikes have come into general use. The former increase the area upon which the load is applied to the tie, thus reducing the tendency of the rail to cut into the tie, and the latter penetrate the wood without damaging the fibres to such an extent as the cut spikes. In the case of a screw spike the tie is usually bored before being placed in the track, and if the tie is to be treated this is an additional advantage, as it allows the preservative to reach the innermost part of the tie at the point where it is most needed. Screw spikes are somewhat more expensive than cut spikes, both in manufacture and installation, but once installed they need less attention than cut spikes. Having a holding over twice that of the cut spikes, and also a greater lateral resistance, they are able to keep the track to better line and gauge. Wherever the nature and volume of traffic requires an absolutely first-class track cut spikes are being generally displaced by screw spikes.

Rails

Although there has been no very great departure from the general use of standard open hearth or bessemer steel rails, there is a growing demand for a rail to be used under special conditions where the wear is exceptionally heavy. To meet this demand the attention of railway engineers and rail manufacturers is being given to two points—namely, the use of rails of larger section, or of harder steel. The maximum rail section in general use at the present day is one of the different forms of 100-lb. rail, but studies are being made in the design and manufacture of rails up to as high as 140 lbs. to a yard. Difficulties are encountered in the manufacture of a rail of this size, particularly with regard to obtaining the best quality of steel in the head.

A great deal of experimenting has been done with special alloy steels, such as manganese, titanium, nickel, and silicon. A difficulty encountered, however, in steels of this nature is that, although they are extremely hard and wear well, they have not the ductility of an open hearth steel, with the result that fractures are apt to occur frequently. It is rather an unfortunate condition that the heaviest wear on rails, naturally occurring at approaches to terminals, frequently occurs in tunnels and where electric traction is employed. It has been found that the life of a rail in a tunnel is only about half of what it would be under the same traffic conditions in the open, and it is also found that the type of electric equipment generally used decreases the life of an ordinary rail, partly by corrugation, and partly from other causes. Multiple-unit cars as used in subways are probably the worst offenders in this respect. In cases where all these adverse conditions (i.e., tunnels, heavy traffic, and electric traction) are met, particularly if on curves, it is becoming quite common to use a manganese steel rail, an average composition of which may be taken as follows:—Carbon, 1.0 per cent.; phosphorous, not over .1 per cent.; and manganese, 10 to 15 per cent. Rails of this nature are tested very carefully for soundness and for ductility, as opposed to brittleness. A steel of this nature is so hard that it is impossible to drill it in the field, and all holes have to be punched before the rail is placed in the track.

A very important point in connection with rail manufacture—or, more correctly, rail purchasing—is the thorough testing of the rail and steel. In this connection it is usual to make a chemical analysis of the steel, obtaining the proportions of the elements—carbon, manganese, phosphorus, silicon, and sulphur—for each heat, and in addition physical tests are made to determine the ductility and soundness of the rails. These tests are made by taking a length of rail about 4 feet long, supported at each end, and subjected to a number of blows from a "tup" usually weighing about one ton. In addition to this form of testing, if the elongation is satisfactory, a "nick and break" test is applied to determine the soundness of the metal in the centre of the rail. These test pieces are usually taken from at least three ingots of each heat.

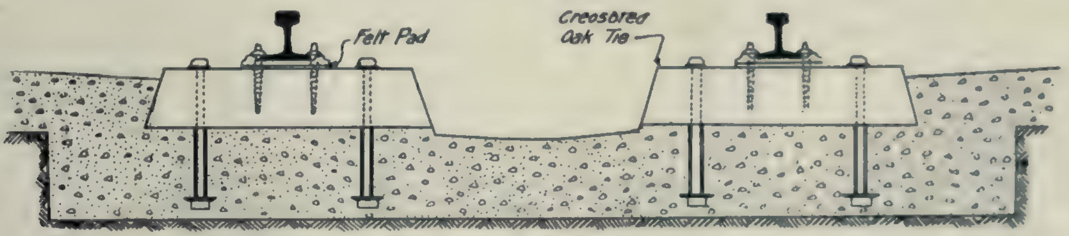


Fig. 5.—A form of track construction commonly used in large U. S. terminals.

Switches and Crossings

One of the most notable changes in connection with switchwork that has taken place in recent years is the use of a very much flatter frog. Until a few years ago it was quite unusual to find a switch with a frog flatter than the No. 10 or 12, whereas to-day a No. 20 frog is used as a standard for main line work on a large number of American roads, and a No. 24 even is used occasionally. A No. 20 switch has a lead of about 370 feet, but a curvature of only 1 deg. 45 min., whereas a No. 12 frog requires a curvature of 5 deg. The advantage of this is readily seen, particularly on a four-track road where crossovers from the main to the local tracks are more or less frequent. A train can pass from one track to another over a No. 20 crossover practically without slowing up, whereas a No. 12 crossover usually carries a speed restriction of 20 miles an hour. Another feature which has been introduced in order to enable trains to pass through a turnout at comparatively high speed is the shaping of the switch points into the form of a spiral, eliminating the sudden change from tangent to curve. The use of very long switch points, i.e., 30 or 33 feet long, also facilitates high speed operation, as the angle of a 33-ft. point with the stock rail is only 50 minutes, whereas the old 16 ft. 6 ins. point makes an angle of 1 deg. 40 min.

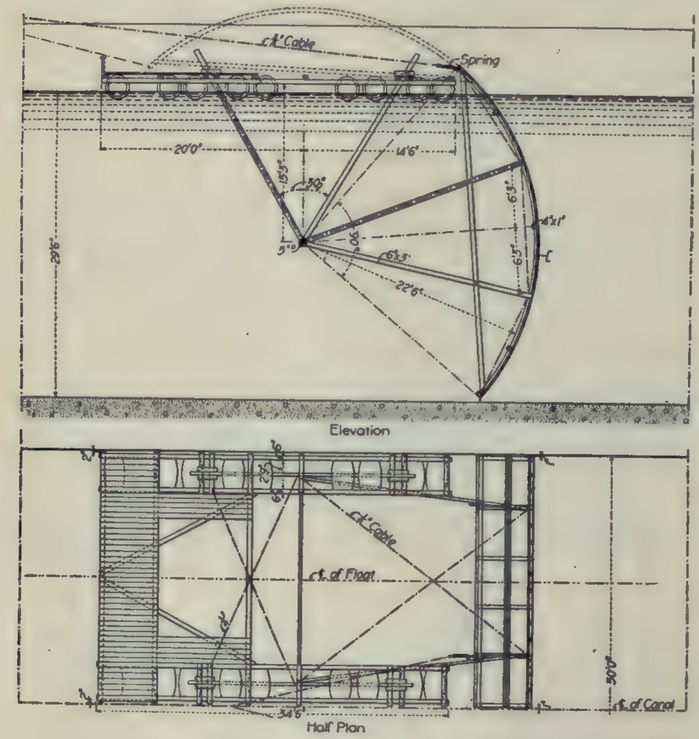
The extensive use of slip switch crossings has enabled track layouts at yards and terminals to be designed in such a way as to permit the maximum of movement of trains in and out of a terminal. A typical instance of the use of these crossings is illustrated in Fig. 3, where double ladders are used on each side of the main tracks, enabling incoming and outgoing trains to reach or leave their platform tracks with the minimum of interference. Switches and crossings used in terminal yards naturally have to withstand very rough usage, and it is essential that their life should be as long as possible on account of the difficulty of renewing them with traffic continually passing. To this end manganese steel is generally used at those parts of the switches or crossings where the maximum of wear is obtained. When manganese steel was first used for this purpose the switch points were made entirely of this steel, but it is now more common to use a switch point with a length of 30 inches at the point made of manganese steel. This is riveted to reinforcing straps on each side of the web, holding it securely in place. Crossing frogs are made with a cast manganese insert at the centre, but there are a number of variations of this practice, such as a frog built up entirely of manganese steel rails, or made in a single casting of manganese steel. The manganese insert is, however, most commonly used, and as the life of the other part of the frog is usually greater than that of the centre, the centre casting is renewed frequently. A slip switch heavily strengthened with manganese steel is illustrated in Fig. 4.

Concrete Track Construction

A form of track construction that is being commonly used in large terminals in the States is illustrated in Fig. 5. It differs radically from the standard ballasted track in that a solid bed of concrete is used in place of ballast. The rails are supported on short ties, 2 ft. 6 ins. long, embedded in the concrete and fastened in place by means of bolts. It is usual to place a hair felt pad between the tieplates and the tie in order to provide the resilience that is ordinarily obtained in ballast. This type of construction is now being frequently used for tracks adjacent to the passenger platforms in large terminals, partly on account of its extremely neat and clean appearance, and partly on account of the small amount of work necessary to maintain it in good shape, the only maintenance work being that of removing refuse. It is also being used, with variations, in tunnels. The disadvantages of the regular form of construction with ballast in tunnels are that considerable maintenance work is necessary, usually under adverse conditions, and that tie renewals are difficult because they cannot be taken out endways, as is usual in the open, but the whole rail must be removed and the tie lifted out vertically. This, of course, is a slow and tedious operation, and blocks the line for a considerable period. With concrete track construction these difficulties are eliminated, as maintenance is reduced to a minimum, and the renewals, which will only take place normally about every twenty or thirty years, can be made without disturbing the rail.

Measurement of Flow in Open Channels

MEASURING the flow of water in open channels is generally done by current meters or Pitot tubes. Both of these methods, however, require long periods of time, and other devices have been developed, says the Engineering Record. One of these methods that has been developed in Europe is the screen method, which in addition to being quicker than the other also is considered more accurate. Its inventor is Prof. Eric Andersson, of the University of Stockholm, Sweden. The method as first developed required a carefully aligned track on which a three-wheeled carriage ran. From this carriage the screen was suspended and hinged so that it could be dropped into position quickly. Several apparatuses of this kind have been installed, the most notable being at the testing flume of J. M. Voith, turbine builders at Heidenheim, Germany. At Notodden, Norway, there is another installation of the same type.



Details of float and curved screen for measuring flow.

This type of screen is at this time considered antiquated, and is almost entirely brought out of date by the improvements which Professor Andersson has made on his method. The drawbacks of the method as originally devised were that a carefully aligned track was necessary, that the screen was vertical and thus when dropped had an angular movement, that the aluminum wheels and ball bearings of the carriage needed constant attention so as to ensure against excessive friction losses, and that wind pressure on the wheels increased the rolling friction.

In 1910, when the large turbines at Trollhattan in Sweden were to be tested, Professor Andersson revised the design of his apparatus and eliminated many of the above-mentioned drawbacks. The screen was curved and pivoted below the water surface, and the carriage replaced by a float. The apparatus is shown in the accompanying drawings. The float is supported on empty barrels, and is made of 6 x 6-in. lumber. The screen is made of light channels, metric system, about 2½ ins. high and 1.6 ins. wide, and weighing 4¾ lbs. a lineal foot, curved at a radius of 22 ft. 6 ins. On both sides of these channels, at frequent intervals, are 4 x 1-in. boards spaced in pairs and separated by small wooden blocks. Lateral stiffness was obtained by stretching ¼-in. cables diagonally in the panels. On this frame was fastened a cover of tarpaulin so as to obtain water-tightness. Four radial 6 x 3-in. timbers, two on each side, served to connect this screen with the submerged pivots on the float. Between the lower pair of these timbers a cross bracing of ¼-in. cable was made so as to prevent deformation. The whole apparatus was built in a way similar to that of a Tainter gate. At the bottom of the screen there was a loose, hinged part to provide a water seal against the bottom of the canal. The design of the float is apparent in the accompanying drawing.

As the canal was 50 ft. wide and 29 ft. 6 ins. deep, it was deemed wise to build the float and its screen in two parts, each 25 ft. wide, and connect them side by side when in use. This arrangement facilitated the construction and the handling of the device when not used for measurements.

The rectangular portion of the concrete canal is about 115 ft., and at its upstream end it is crossed by a highway bridge. On this bridge the recording apparatus was placed and connected with the screen by a ¾-in. wire rope, which was branched and thus connected with both halves of the float. The recording drum was driven by the pull on this cable at a speed one-twentieth the speed of the screen, while a pencil actuated by clock work marked every 0.01 min. The speed was also measured on a scale 65 ft. long laid out on the concrete work of the canal bank. Two men, each provided with a chronograph, recorded the time required by the screen to move a certain distance. In comparing the results of the two methods it was found that the chronographic method was less accurate than the diagram apparatus, and therefore its records were not used. As the discharge in the canal was used to feed the turbine under test, only the measured velocities were low, varying from 0.3241 to 0.8807 ft. a second, and the corresponding discharges from 508.9036 to 1375.5528 sec.-ft. Afterward the leakage through the gates on the spillway in the forebay and through the closed headgates was measured and found to be 1.7658 sec.-ft.

These tests were made June 24 to 26, 1910, under the supervision of Professor Andersson and E. Andren, at which time four main turbines had been installed. During May 10 to 13, 1913, when two more units had been installed, the screen was again used with very much the same results as described above. It was found, however, that the leakage had increased by 60 per cent., while the area of the headgates had been increased by less than 50 per cent. These latter tests were made under the supervision of A. H. Lindfors, Arvid Lindstrom, and Anders Rosborg.

What Constitutes a Completed Job of Road Work

By A. McGillivray, Highway Commissioner for Manitoba

IT would be a source of profoundest gratification indeed to road builders, municipal men and ratepayers alike, if at some time in the history of a road it would be possible to say that it was completed and that no more attention need be given it. This is an ideal condition in the life of a road that cannot be hoped to be attained. However, there are certain factors that enter into the building of a road that can be settled definitely and remain permanent fixtures therein.

The first point that should be settled before actual construction begins, is the location of the road. This is determined by its relative position in the district to be served, the comparative cost of construction with other locations and its general suitability to the purpose intended. The allowances set apart for road purposes in the Prairie Provinces of Canada are defined in the original survey of the country into its legal subdivisions, and follow the boundary lines of the sections. This in itself, while providing a right-of-way for road purposes at regular intervals throughout the country, often proves a source of extra engineering difficulties and expense when they are being transformed into travelled ways. The lines of demarkation of the townships and sections are run in set directions —north and south, and east and west—regardless of the topography or physical feature of the country. The efforts of the highway engineer, in so far as selecting the most suitable location for a road are, therefore, very much circumscribed and limited by having to accept the allowance thus provided for that purpose.

The alignment of the road should receive careful attention when construction work is being undertaken and improvements are being performed.

Whether the right-of-way selected be a Government road allowance or a diversion therefrom, which latter course in some instances is absolutely necessary in order to avoid large bodies of water or hills which could only be crossed by following a straight course at prohibitive gradients or unwarranted costs, the centre line of the roadway should be fixed and the proposed improvement made about it so that where subsequent improvements or alterations in standard of road are found desirable, they may be made without disturbing work previously done.

It is customary, when laying out road work in this province, for the engineer to make the centre line of the roadway coincide with the centre line of the road allowance, and unless there be good and sufficient reasons present in a given case for deviating from this by placing the travelled road in some other relative position on the allowance, this rule should be strictly adhered to. The point to be emphasized in this connection is, that the finished roadway, the necessary drains, culverts, and bridges should conform to such well defined lines and courses that their positions on the road allowance may become, practically, permanent fixtures. It might be here stated that the width of roadway on rural main roads should be 18 feet. This width should be increased at the approach of towns and cities to 20 and 24 feet, depending altogether on the amount of traffic to be accommodated. The inside lines of the ditches should be parallel with the centre line of the roadway, and not closer than 14 feet thereto. This arrangement will give a stretch of ground twenty-eight feet in width upon which to construct the roadway. The slopes of embankments and cutting, except in rock, should have, at the least, a slope of one foot and one-half horizontal measurement to one foot vertical.

Another important feature in connection with the building of a road is the determining of the profile which the surface of the finished roadway should assume. This is accomplished by a study of the profile of the natural surface of the ground to be traversed, and by so altering the same by means of embankments over stretches of comparatively level country, or by cutting down hills and elevating the intervening depressions where the surface of the country is rolling or broken, until a finished profile suitable to the nature and conditions of the soil met with is obtained. It is largely a matter of judgment based on knowledge gained from experience that enables an engineer to determine the proper height of fill which should be constructed across a certain stretch of country or the depth of cutting that should be made through a ridge. No said standard can be fixed to meet the varying conditions met with. If the land is low and flat, and is liable to be affected by the accumulation of water in times of freshets, the embankments will necessarily have to be higher than over land where drainage is more easily effected. Where the country is rolling and the profile a series of ridges and depressions, an excellent road can be made by cutting the ridges and filling in the depressions and a grade line so established that the amount of excavated material from the ridges and the amount of the material in the embankment would balance. Again there may be met with tracts of country where the soil is light, and natural drainage good, where the surface of the ground may be but little disturbed to provide a splendid roadway.

It is when building a road over a steep hill or across deep ravines, or across the valleys of some of the larger rivers in this country, where the determining of a proper profile for a road requires consideration and thought. The maximum gradient which might be permitted on a main highway is six per cent., or a rise of six feet in every one hundred feet horizontal measurement. A much less gradient should be first sought and the maximum aforementioned only adopted when the engineers' difficulties encountered are of such a character that the cost of securing any substantial reduction might be considered prohibitive or unjustifiable.

The gradient of a hill may be reduced by increasing the depth of the summit cutting or by increasing the length of the road. The latter method is preferable. Deep cuttings are objectionable, especially as in the winter seasons, unless protected by snow fences, they are liable to drift full of snow and cause blockades on the road. While it is almost impossible to entirely avoid them in rough mountainous regions, still, in endeavoring to reduce the gradient, distance should be increased by following the most practical course open along the slope of the hill until the bottom is reached, where the direction may be corrected on the flats below.

The bad effects of the steepness of hills are especially felt in the winter, when the ice covers the road, because the slippery surface causes danger in descending, as well as increased labor in ascending. If a hill has to be ascended, the road up it should nowhere have the smallest descent, for that would make two hills instead of one. It should be so located, and have such cuttings and fillings, as will secure a gradual and uninterrupted ascent the whole way. In this respect engineering skill can make wonderful improvements and will assist wonderfully in selecting the best possible location for the road.

No job of road construction can be considered completed that does not provide adequate drainage facilities. By this is meant the construction of the necessary surface drains, or underground system of tile drains, and the placing of all culverts required in connection therewith, so as to permit the escape of all water which may accumulate along the road.

The cross section of the road should be so shaped that water will not lie upon its surface, but will have free and uninterrupted access to the gutters or side drains. This is a very essential factor in the life of a road. The construction and preservation of a properly shaped cross section adds to the comforts and conveniences of travel upon it, and lengthens the life and usefulness of the road to an inestimable extent.

The cross section of an earth road will require a greater rise at the centre than a hard surface road, but care should be taken not to make this excessive, because it will have the effect of concentrating the traffic at the centre—that being the only part of the road where a vehicle can retain an upright position and thereby cause ruts to be formed which will prevent the rain water falling on the surface to escape to the side gutters; very much to the injury of the road. The rise given to the crown of a road should bear a certain proportion to the width of the roadway. For earth and gravel roads, this rise should be about one twenty-fourth of the width of the road surface. Macadam roads do not require this amount, and possibly about one-fortieth of the width would be sufficient. On asphalt, brick, creosoted wood block, or other surface, the rise may be reduced still more.

Upon the foundation depends the permanency and stability of any road whether it be the common earth road or the highest class of pavement. If the foundation is weak and faulty, the surface will soon become broken and impassable. The character of the natural soil over which the roadway is to pass has an important bearing on the forming and kind of foundation. But whatever be the character of the soil, it must be kept dry. Sands and gravel which do not hold water present no great difficulties in securing a solid foundation. It is with clays and soils of retentive nature where the greatest difficulties are encountered.

The essentials necessary to forming a good foundation are:

(1) The entire removal of all perishable or yielding material.

(2) The drainage of the sub-soil wherever necessary.

(3) The compaction of the natural soil by a roller of proper weight and shape.

Where the traffic demands a more substantial and unyielding foundation than the natural soil will afford, a fourth essential may become necessary, as the placing upon the natural soil compacted as aforementioned a sufficient thickness of hard durable material such as rock or concrete.

It is the foundation of a road alone, where even relative permanency is possible to be secured, and this can only be accomplished by exercising the greatest care in forming it and afterwards protecting it from the destroying actions of traffic and the elements by a suitable wearing surface.

This wearing surface may consist of a coating of gravel, macadam, asphalt, brick, or other pavement that will act as a protection to the foundation. Upon it comes the inevitable wear and tear of traffic and in a well designed and constructed road this should be the only portion requiring repairs or replacement so long as the original design of the road remains suitable for the traffic upon it or capable of withstanding any extra traffic that it may through time be exposed to.

A completed job of road work should include permanence of location, adequate drainage facilities, foundations and surface covering compatible with the demands of traffic upon it so that transportation and intercommunication can be carried on with safety to the public with the least possible inconvenience and the lowest possible cost.

Specifications for Concrete Pavements

SOME interesting points in the specifications for concrete pavements, written by M. M. O'Shaughnessy, City Engineer of San Francisco, and recently adopted by the Board of Supervisors, follow: The concrete is of 1:2:3½ mixture. After mixing, the concrete is deposited rapidly in successive batches; the concrete is deposited to the required depth and for the entire width of the pavement in a continuous operation between transverse and longitudinal joints without the use of intermediate forms or bulkheads. In case of a breakdown, concrete must be mixed by hand to complete the section or to an intermediate transverse joint placed at the point of stopping work. Any concrete in excess of that needed to complete a section at the stopping of work is not to be used in the work. Longitudinal joints filled with ⅛ in. of prepared felt are constructed between the curb and the pavement on each side of the roadway, and along the centre line where the roadway exceeds 25 ft. in width. Transverse expansion joints are constructed in straight lines at right angles to the centre line of the roadway for the full width of the pavement and at intervals not exceeding 25 ft. The surface of the pavement is sprayed with water as soon as the concrete is sufficiently hardened to prevent pitting and is kept wet until a sand covering is placed. As soon as this can be done without damaging the concrete, the surface of the pavement is covered with a layer of sand at least 1-in. thick, and covering kept moist for at least 10 days. The pavement is not to be opened for traffic for a period of at least 20 days after being laid. The contractor is required to maintain the sand covering for a period of at least 10 days and must erect and maintain barriers to protect the concrete from traffic, and any part of the pavement damaged by traffic or other causes prior to its official acceptance must be repaired or replaced by the contractor at his own expense in a manner satisfactory to the engineer.

Concrete as a Paving Material

By J. F. Rhodes[*]

DURING the last few years the use of concrete as a paving material has had a very rapid growth both in Canada and the United States. Up to the end of the year 1907 records show that only twenty-seven municipalities in the United States and four in Canada had used concrete.

The most noteworthy of the early pavements in the United States is that at Bellefontaine, Ohio, which was constructed in 1893. This pavement was laid on the market square which naturally was subjected to heavy traffic. After standing traffic twenty-two years, it is still in use and in good condition. Other early users in the United States were Richmond, Ind., and Chicago, Ill. The latter city laid 80,000 square yards previous to 1908.

The early users in Canada were Toronto, Woodstock, and Windsor, Ont. The two former places used it only in lanes, Toronto first laying concrete in 1898, and Woodstock in 1905. Toronto continued its use in lanes to a very limited extent until 1913. During the years 1913 and 1914 the city laid approximately six miles. Windsor first used concrete for street paving in 1907, when they constructed six streets, totalling 35,000 square yards, at a cost of approximately $1.00 per square yard. Windsor at present has approximately twenty-five miles of concrete in residential streets and it is practically their standard type of construction.

During the last few years the increased yardage of concrete has been very marked. Below are tables showing the approximate yardage laid in Canada and the United States to date. In Canada a large percentage of the concrete has been laid as pavements in municipalities. The largest system of concrete pavements is in Windsor, mentioned previously, and the longest rural highway is that in Laval County, Que., on Isle Jesus, from Pont Viau to the Ste. Rose Parish, a distance of 6½ miles. The following table gives data on Canadian concrete pavements:

Year	Number of Places	Yardage	Total Yardage
Up to 1908	3	42,189	42,189
1908	3	30,617	72,806
1909	4	24,983	97,789
1910	8	158,790	256,579
1911	9	86,605	343,184
1912	18	237,622	580,806
1913	38	468,799	1,049,605
1914	41	550,305	1,599,910

In the table showing concrete pavements in the United States, the yardage includes both city streets and rural highways. Data is not at hand which shows what proportion is city street paving. However, statistics indicate that 286 cities in the United States built concrete in 1914 totalling 4,787,003.56 square yards. Previous to 1914, 448 municipalities had used concrete for street paving.

Concrete Pavements in the United States

Year	Amount	Total Amount
Up to 1909	1,141,500	1,141,500
1909	274,000	1,415,500
1910	1,026,600	2,442,100
1911	1,861,100	4,303,200
1912	5,556,656	9,579,856
1913	8,576,160	18,436,016
1914	Not complete	....

In the development of concrete pavements many changes have been made in their design and construction. In the early work they were built on the same principle as sidewalks, having a bottom course of concrete with a cement and sand top, and finished in the same manner as sidewalks. It is now more general to build the pavements of one-course concrete throughout, using a rich mixture of concrete, the standard specifications being in proportions of 1 part of cement to 2 parts of sand and 3 parts of crushed stone or coarse gravel. It is also the custom to make joints in the pavements at intervals of not less than 25 feet, in place of making them in small slabs as in the earlier ones. When using concrete for the paving of city streets and in all roadways which are 20 feet or more in width, it is becoming the practice to reinforce them by the use of a woven steel fabric placed not less than 2 inches or more than 3 inches from the top surface of the pavement. This reinforcing is intended to overcome the chances of cracking of the concrete from the shrinkage stresses and the stresses induced by the moisture contained in the concrete. Where reinforcing is used for bad conditions in the foundation this has to be designed according to special conditions.

There has also been a great advance in the manner in which concrete for street purposes is constructed. The work is now done much more rapidly owing to the use of better machinery, and greater care is taken with the mixing of the concrete. The latest specifications require that all the concrete should be mixed at least three-quarters of a minute in the batch mixers. This is done in order to obtain a concrete which will be absolutely uniform and thereby wear at the same rate in all places, and be of uniform strength throughout.

From results already obtained in concrete street paving many engineers are of opinion that concrete, when properly built, gives one of the most durable pavements for the money expended.

Sixty-three municipalities in Canada have constructed concrete pavements, and nearly all of these have added to the streets first built. This indicates that concrete pavements are meeting the needs of many municipalities and are proving satisfactory to those who use them.

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[*] Of the Canada Cement Company.

Production of potash from feldspar by a new process is described by E. W. Coggeshall in a paper before the National Lime Manufacturers' Association. Powdered feldspar is mixed with one-fifth its weight of powdered quicklime and sprinkled with a solution of calcium chloride. The calcium chloride binds the powder into lumps. These lumps are fed to a rotary kiln similar to a cement kiln, and under the influence of the high heat the potash in the feldspar is released from its union with the silica and unites with the chlorine to form muriate of potash, which is readily soluble in water. By leaching the lumps discharged from the kiln, a solution of about 10 per cent, of muriate of potash is obtained. The water in the solution is evaporated by the waste from the kiln gases. It is stated that the potash salts obtainable in this way can be produced commercially for a lower figure than those imported from Germany under normal conditions. The total importations of potash salts from Germany during 1914, notwithstanding the interruption to the business during the last four months of the year, amounted to nearly 486,000,000 pounds, valued at $8,750,000.

The Economics of Pavement Repairing

Providing a Roadway for an Indefinite Continuous Period at Minimum Expense—Method of Determining Limit beyond which Cost of Maintenance by Repair Exceeds that of Renewal

HOWEVER well a roadway may be constructed, there must be repairs, and such will increase in extent and expense until a limit is reacher where renewals are dictated by considerations of economy, says George H. Norton in an article in The Cornell Civil Engineer. While there may be an interesteg possibility of maintaining a roadway in satisfactory service by continued repairs for an indefinite time, such to-day appears a remote contingency. The requirement to be met is that of minimum expense for providing a roadway for an indefinite continuous period of time, or determination of the limit where maintenance by repair exceeds in cost maintenance by renewal. To determine this limitation we must know the cost of repairs year by year and the cost of renewal, which theoretically may be the same as the cost of original construction.

Some hold that sinking fund provisions, etc., should enter into this determination, but a full consideration of the various methods by which funds are provided and the varying values of moneys to the diverse contributors to the expense seem to make this an unnecessary refinement, at least until a general theory is better founded and accepted.

For this discussion we accept the fact that pavement repairs increase with the age of the pavement, and will further assume that the cost of renewal of wearing surface is equal to the original cost of providing such surface.

Where repairs increase directly as the first power of the age, then the economical limit of life is reached when the total cost of repairs equals the cost of the article. When these repairs increase with the square of the age, then the limit is reached when repair cost equals one-half that of the article. If the repair rate increases by any uniform rate, then a mathematical solution can be reached for minimum cost of providing a continuous surface by repairs or renewal.

Unfortunately, the variations in soil, climate, traffic, and materials, plus the ever-present limitations of human judgment, make most unlikely any regular curve of increase in repair cost of a single road or pavement. No average result of a number of examples can be truthfully used as a criterion for a single case. The determination must, therefore, be made from the record of the individual pavement, although such determination may well be made in the light of a knowledge of general behavior and limitations of other similar construction. The method here proposed is simple in its application, readily understood by the layman, and is apparently as accurate as this problem at its best will warrant.

To determine the economical limit of repairs two variables must be considered, and the limit will occur at the minimum of their sum. If a pavement surface is used for twenty years, one-twentieth of its cost may be taken as its annual depreciation; but if in use but ten years, then one-tenth the cost is the annual depreciation. For any particular class of pavements there may be prepared a table of depreciation by dividing the cost of renewable surface by numbers representing the age of the pavement. For the cost of repairs, if at the end of ten years 10 cents per yard has been expended for repairs, the average rate has been one cent per year. If at the end of twenty years 60 cents per yard has been expended, then the average repair rate has been three cents per yard per year.

For an application of this method the following tabulation is made:—

Age	Annual cost of repairs		Average annual cost of of repairs	Annual allowance for renewal	Annual cost of pavement
1 to 7	....	3.0	...	....	....
8	2.7	5.7	0.7	18.8	19.5
9	0.8	6.5	0.7	16.7	17.4
10	12.9	19.4	1.9	15.0	16.9
11	4.9	24.3	2.2	13.6	15.8
12	0.6	24.9	2.1	12.5	14.6
13	2.1	27.0	2.1	11.5	13.6
14	2.2	29.2	2.1	10.7	12.8
15	1.4	30.6	2.0	10.0	12.0
16	0.9	31.5	2.0	9.4	11.4
17	2.9	34.4	2.0	8.8	10.8
18	3.0	37.4	2.1	8.3	10.4
19	0.3	37.7	2.0	7.9	9.9
20	3.1	40.8	2.0	7.5	9.5
21	5.8	46.6	2.2	7.1	9.3
22	3.5	50.1	2.3	6.8	9.1
23	9.6	59.7	2.6	6.5	9.1
24	5.9	65.6	2.7	6.3	9.0
25	4.2	69.8	2.8	6.0	8.8
26	....	69.8	2.7	5.8	8.5
27	8.3	78.1	2.9	5.6	8.5
28	12.5	90.6	3.2	5.4	8.6
29	6.9	97.5	3.4	5.2	8.6
30	5.0	102.5	3.4	5.0	8.4
31	5.2	107.7	3.5	4.8	8.3

In the above tabulation the cost of renewable surface is assumed at $1.50 a square yard. This amount is divided by the consecutive numbers representing age of pavement (column 1), and gives the annual allowance for depreciation as shown in column 5. The actual expenditures made annually for repairs per square yard are given in column 2. In column 3 are shown the totals of such repair cost to the given year, and in column 4 the average cost of repairs per year to that date (column 3 divided by column 1). Column 6 (the sums of columns 4 and 5) shows the cost of depreciation plus cost of repairs, and in this is to be found the minimum or limit of repairs. This example shows that the cost of providing the pavement over a term of years, depreciation plus repairs, had been a decreasing one except in the 28th year, where a large repair expenditure had raised the annual cost, but that a lower cost was reached thereafter.

An immediate use of such a tabulation is found in determination of the allowable repairs for any year. An inspection at once shows, with an annual cost of 9.5 cents per yard per year at the 20th year, that if 9.5 cents be expended in the 21st year the annual cost rate will remain the same. As the repairs in the 21st year were less than 9.5 cents (5.8 cents) the average annual cost was reduced to 9.3 cents. Had it exceeded 9.5 cents the average annual cost would have been increased. From the above considerations the following rule is formulated:

The allowable repairs for a succeeding year should not exceed the sum of the total cost of repairs to date, plus the cost of the wearing surface, divided by the age of pavement, and when the necessary repairs would exceed such amount the street should be resurfaced. This rule, like the celebrated artist's paints, should be applied with brains. It is believed to be sound, simple, easy of application, and a valuable aid to an engineer's broad judgment.

To fairly discuss the rule some applications are given. These are from maintenance records of sheet asphalt pavements in Buffalo, N.Y., where detailed records of yearly costs are available for nearly 700 contracts. In figure 1 are shown annual cost (repairs plus depreciation) for six streets with fairly uniform repairs. There is also plotted for reference the curve of depreciation (cost—150 cents—divided by age), all figures in cents per square yard. Fig. 2 shows the same record for three streets in which the rule of minimum cost has been violated and repairs continued.

These streets may be described briefly as follows:

(1) 17,235 square yards, heavy traffic, about 5,000 tons per day, now in good condition except somewhat uneven.

(2) 5,800 square yards, heavy traffic street. Condemned in 24th year.

(3) 19,100 square yards, medium traffic street. General conditions warrant an early condemnation.

(4) 22,500 square yards, medium traffic. Condemned in 31st year and repaved in 32nd year. This street is used for further study in figure 3.

(5) 8,900 square yards, residence street. Laid on a bituminous base. Surface worn very thin, but bituminous base prevents deep holes.

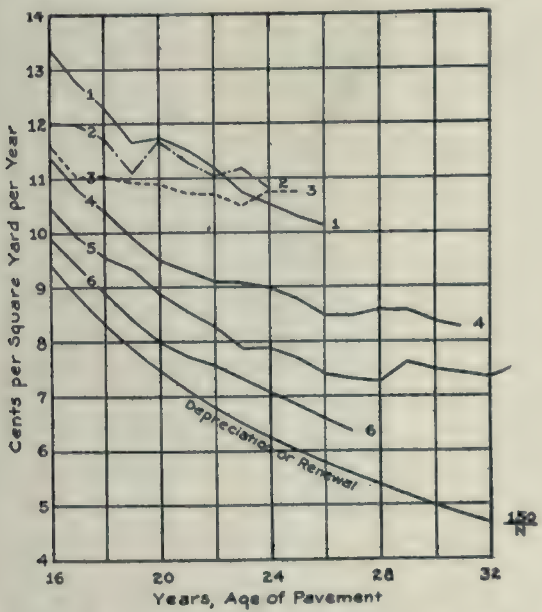

FIG. 1. ANNUAL COST OF CERTAIN PAVEMENTS AT VARIOUS AGES.

Cost of surface plus cost of repairs divided by age of pavement, with depreciation or renewal curve for determination of minimum cost.

(6) 5,800 square yards, short residence street of exceptionally low repair costs, 0.8 cent per yard per year for 27 years; apparently destined for long life.

(7) 7,000 square yards, residence street in fairly serviceable condition. In its 22nd and 23rd years 27.6 cents per yard was expended for repairs.

(8) 13,400 square yards, medium traffic street. One of several streets laid same year on which guarantee was voluntarily extended 3 years. In its 24th and 25th years 48.6 cents per square yard was expended for repairs. Now in fair condition.

(9) 18,200 square yards, medium traffic residence street, now in fair condition. In 22nd and 23rd years 20.9 cents per square yard was expended for repairs.

Some irregularities in these lines are due to known insufficiency of repairs or entire omission for one year.

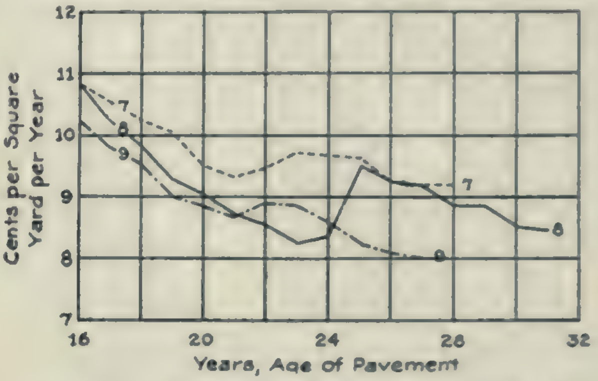

FIG. 2. ANNUAL COST OF CERTAIN PAVEMENTS AT VARIOUS AGES.

Cost of surface plus cost of repairs, divided by age of pavement, where minimum cost rule has been violated.

In applying this rule several points should be borne in mind:

(a) Repairs due to settlements or other local causes may warrant a high rate when such repairs may place the whole surface in a satisfactory condition.

(b) Known deficiencies of repairs for a period followed by such as replace deficiency must be given due consideration.

(c) Due regard for general condition of whole surface. Occasionally pavements exhibit some traits of the celebrated "one horse shay."

(d) If a pavement is plainly of quality below the average of its kind, its annual costs, while decreasing, may be so much above the reasonable expectations for its successor that the rule should be drawn tightly or perhaps forced; while with the reverse condition some leniency may be felt for one which is giving better than average service. This is illustrated by No. 5 above.

The impossibility of making such uniform repairs as to create a smooth curve of annual cost demands a careful study of the line, and a smoothed or average curve of cost may well be sketched and studied in making final decision.

This rule has been applied in Buffalo for about three years, at first as a check upon the opinions of those long in charge of such work, and later as a guide in the formation of such opinions, and it has been found to be most sound and to conform to judgment based on extended experience.

The argument for the use of a sinking fund curve instead of a straight depreciation, while theoretically warranted, has little practical merit.

In Fig. 3 is shown line A_1, straight depreciation or cost divided by age; line B_1 is the sinking fund curve at 4 per cent. compound interest to produce $1.50 at the given age. They depart from the parallel by only about 0.1 cent between 20 and 30 year ages—an immaterial amount. Above these lines have been plotted, as lines A and B, the record of street No. 4 of

Fig. 1, based respectively on straight and sinking fund depreciation; they show no appreciable difference in character to warrant use of the more complicated sinking fund provision.

Another element may well enter into this problem. In the above discussion no allowance has been made for deteriorated condition of a roadway during its determined life. Generally an old surface will be uneven and less desirable even if intact and serviceable, and at times some weight should be given to such condition. It is possible in the rule herein suggested to make allowance for a deteriorated useful value of a wearing surface and also give weight to losses occasioned through interruption of traffic in resurfacing by decreasing or increasing the assumed value of the wearing surface.

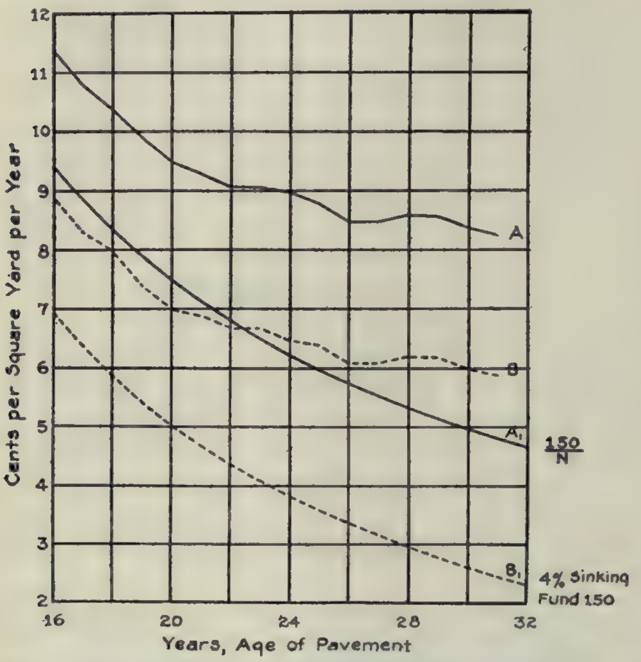

Fig. 3. Flat depreciation or renewal compared with sinking fund provision to show parallelism at critical ages. Repair costs of street No. 4, Fig. 1, added to show similarity of lines of cost.

No attempt has been made to discuss the various theories which have been advanced for this purpose, as such would of necessity be somewhat controversial. The pure theory of limitations of repairs may well have more extended and public discussion than is generally accorded to it. It is of the essence of sound engineering and of vast financial import.

Work on the Second Simplon Tunnel continues in spite of the entrance of Italy into the war. The south end of the tunnel is on Italian territory, the north on Swiss territory; but at present work on the north end is discontinued, while progress at the south end was not interrupted when Italy declared war, except that the number of workmen was reduced by the call to colours, which required the recruiting of a new force. The May advance of each of the various elements of the work (crown heading, full section excavation, side-wall construction, arch construction) in the south end was about 875 ft.; heading work was prosecuted from a number of upraises. The total length of completed tunnel at the end of May was 15,232 ft. in the south end, and 15,987 ft. in the north end, or a total of 31,219 ft., representing 48 per cent. of the final length of the second Simplon Tunnel (65,026 ft.).

The Design of Reinforced Concrete Reservoirs*

SOME of the advantages of reinforced concrete as the material of construction for water-works reservoirs are: there is a saving in first cost; a reservoir built of this material occupies less space than one constructed in masonry or brickwork, or a combination of both; it can more easily be made watertight; it increases in strength with age; there is less likely to be vegetation upon the face of the walls; practically no cost in maintenance.

Circular vs. Rectangular Reservoirs.—In the United States most of the modern reservoirs are circular in plan. Reservoirs of this shape are seldom constructed in England, British engineers preferring a rectangular structure. I recommend the circular shape, the chief advantage being that when of this shape no angles occur, so that the reservoir wall can be built without a joint. This is a great advantage, for one often finds that when leakage occurs in a reservoir it can be traced to the point where the walls join. Circular reservoirs, because of their circular form, are also better adapted to withstand external earth pressure; they are cheaper than rectangular ones.

The Twin Peaks reservoir at San Francisco is a good illustration of the curvilinear type of reservoir. This may be briefly described as follows:

The reservoir was completed about two years ago, and is a good example of what may be done in reinforced concrete. It is oval in plan, and divided into two parts by a reinforced-concrete dam. The reservoir is situated 750 ft. above the business section of the city, and is part of the high-pressure system for fire-extinguishing purposes established in consequence of the great fire of 1906. The depth of water allowed for is 27 ft., and the capacity is 11,000,000 gals. The buttresses of the dam are spaced at 9-ft. centres on both sides of the wall. They are 1 ft. in thickness, and 13 ft. wide at the base.

Watertight Reservoirs.—Referring to the leakage of reservoirs, we would say that this is a problem which has engaged the serious attention of engineers for many years past. Reservoirs have been constructed in what appeared to be a substantial manner, on a good foundation, and at a cost of many thousands of dollars, but they have never ceased to leak, and while many attempts at remedying the leakage have been made, these constructions are looked upon, from an engineering point of view, as a failure.

I know of no type of reservoir, however, which is more likely to be watertight than that constructed of reinforced concrete, provided the reservoir is properly constructed and expansion joints are inserted in suitable positions both in the walls and floor of the reservoir, and if suitable material is used for the concrete, and the walls are not less than a minimum thickness of 5 inches and are well reinforced, and that the depth of water in the reservoir does not exceed, say, 30 feet.

The thickness of the floor will depend entirely upon the sub-foundation. This floor may be either of plain or reinforced concrete; if the latter and the sub-foundation is good, the thickness of floor should not be less than 6 ins. for a depth of water up to 15 ft., and 9 ins. for a depth ranging from 15 to 25 ft., and 12 ins. from 25 ft. to, say, 35 ft. In every case it is assumed that the floor is well reinforced. In order that the reservoir may be watertight, in addition to the before-named precautions, great care must be taken as to the properties used in the concrete. I would suggest that never should a weaker mixture be used than 1:2:4, and where the depth of water to be stored is not less than, say, 20 ft., I would recommend a mixture of 1:1½:3. The materials should be very carefully graded, as most of the trouble in reservoir work occurs where this has been imperfectly done.

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*From an address by Prof. E. R. Matthews, of the Department of Municipal Engineering of the University of London, given at University College, London, Eng.

I also recommend for reservoir work that a wet mixture shall always be used, and while a dry mixture may show a better result as regards its strength in compression, and a plastic mixture may also give better results in this way, still, a wet mixture more perfectly prevents leakage, and on that account should always be used.

Not only so, but with a wet mixture the reinforcement is better covered. I have seen reinforced-concrete work where a fairly dry mixture had been used, and where occasion had arisen for the breaking up of the concrete, where the reinforcement in places had not been covered in the least degree by the concrete. This had occurred, first, because the mixture was too dry, and, secondly, because the aggregate used was too large. In practice the concrete should be of such a consistency that every portion of the reinforcement will be well covered, and every crevice filled.

Not only is this obtained by using a wet mixture, but with such a mixture when the forms are removed there is a smooth face to the concrete, and on this account also it is wise that the mixture should be fairly wet. Care, however, must be taken to see that it is not too wet. It is possible for too large a quantity of water to be added so that the grout will run through the joints in the forms, and escape from the wall; on no account should this occur. If reservoir walls are constructed with a mixture of 1:2:4, the ultimate strength of this concrete, assuming well-graded stone and sharp sand is used as the aggregate, will be about 2,000 lbs. per square inch at the termination of one month, and 2,700 lbs. per square inch at the end of six months. The usual working stress for good concrete is taken at 600 lbs. per square inch. Under exceptional circumstances, however, this may be reduced to, say, 500 lbs., but I would recommend, generally speaking, for reservoir work, 600 lbs. per square inch.

Reservoir Piers.—These are sometimes built circular in plan, and there is a slight saving in the space occupied by so doing. It is, however, more costly to construct the forms in this shape, and the advantage of saving in space does not really compensate for the increased cost. The usual practice in this country is to build rectangular piers, and to chamfer the edges, say, with a 1½-in. chamfer to a 10-in. or 12-in. square pier. The square pier has the advantage also that it affords a better seat for the reinforced-concrete beams carrying the roof to rest upon.

Reservoir Roofs.—In reinforced-concrete reservoirs this usually consists of a reinforced-concrete slab 5 ins. or 6 ins. in thickness, carried by reinforced-concrete beams which rest on the piers just referred to. Some engineers prefer a lighter slab, and to ensure this they introduce a system of secondary beams. For my own part I do not care for the roof slab to be of greater thickness than 6 ins.; 5 ins. is preferable, and the beams can be designed accordingly. In calculating the weight of the roof it is necessary to include the weight of concrete and reinforcement forming the beams and slags, also to allow for any soil which may be spread on the roof. This is usually about 1 ft. or 18 ins. in thickness, also to assume a thickness of snow of, say, 2 ft. It is necessary to construct two or three openings in the roof for the purpose of getting to the inside of the reservoir, and iron ladders are usually built in at these points. The openings need not be larger than 6 ft. by 3 ft.

Cement Grouting.—It is always advisable after short sections of the work have been completed to wash the walls over with two coats of cement grout, 1 to 1 (sand and cement). This fills in any slight cracks which may have occurred on the surface of the concrete. A fortnight should elapse before the grout is applied. No further cracks on the surface of the concrete will be likely to occur.

Wetting Concrete.—If the reservoir is being built during the summer months, when the sun is likely to dry the surface of the concrete very rapidly, the latter should be frequently wetted so as to retard the driving action of the sun. It is also advisable to do this in high winds.

Size of Aggregate.—In reservoir work the aggregate used in the construction of the concrete walls, floor, piers and beams of the reservoir should be capable of passing through a ¾-in. ring; for the roof slabs it should be capable of passing through a ½-in. ring.

Where the thickness of the concrete floor exceeds 9 ins. the aggregate should be capable of passing through a 1-in. ring, the upper 4 ins. of the concrete in the floor should consist of concrete, the aggregate of which is capable of passing through a ¾-in. ring.

Reinforcement.—It is not my intention to advocate any particular system of reinforcement. There are many in the market, and most of them are good, and I say this after having used several different systems myself. It is quite possible, however, and I strongly advise you to adopt this course, for the municipal engineer to work out his own stresses and design his own system of reinforcement.

Thickness of Walls.—For heads up to 10 ft. a 5-in. wall will generally be found to be sufficient; a 4-in.

MY SON

I that had yearned for youth, my own, again,
And mourned the wasted hours of younger days,
I that had sighed for Spring, for Summer, when
The snows of Winter covered all my ways—
I that had prayer for years, for only one,
Have found that prayer answered in my son.

He is myself again, with hopes of old,
With old temptations and with old desires:
He is myself again—the clay to mold
Into the man, and all the man aspires.
Who says that youth returns to us no more?
He is as I was in the days of yore.

In my own days, in my own days of youth,
Ah, how I wished a comrade and a friend!—
To help me keep the quiet path of truth
And through temptation my own feet attend.
So shall I journey onward by his side,
His father—yes, his comrade and his guide.

I that have failed shall shape success in his,
I that have wandered point the proper path,
A signal when the signal lights are dim,
A roof to fend him from the storms of wrath—
So we shall journey upward, I and he,
And he shall be the man I meant to be.

—Douglass Malloch.

will answer, but I prefer a minimum thickness of wall of 5 ins. It has, however, been suggested that the walls should be increased in thickness for every additional 5 ft. increase in head pressure. I agree with this suggestion, but prefer that the top 6 ft. of the reservoir wall shall be 5 ins. in thickness, and that the wall shall be increased in thickness by 2 ins. for every additional 6 ft. of its height.

It is usually desirable to build counterforts or buttresses at the back of the wall.

There is a saving of from 20 to 25 per cent. by using reinforced concrete in the construction of reservoirs. Some engineers recommend that the water face or reservoir walls shall be plastered with 1 to 1 cement mortar to a thickness of ½ in. or ¾ in., but I do not favor this; I think it is unnecessary.

Stresses.—The elongation of steel being so much greater than that of concrete, it is advisable, in order to ensure of the reservoir being watertight, to limit the stress to 12,000 lbs. per square inch, and I think it is advisable in reservoir work to use bars which give a mechanical bond, such as the indented bar, twisted bar, lug bar, or one of the other various types of bars, rather than plain bars, but this only applies to reservoir work, as plain bars are admirable for all other reinforced concrete work.

It is necessary that an adequate percentage of steel be inserted in the concrete in both directions, even when the stresses due to water pressure occur in one direction only, or otherwise slight cracks may occur.

Backing of Reservoir Walls

Reservoirs may be: (a) Entirely sunk below ground; (b) partly sunk below ground; (c) out of ground.

(a) **Reservoirs Sunk Below Ground.**—On designing the first type we must remember that the reservoir may be full or empty. When empty the walls will be acting as retaining walls with all the pressure at the back; when the reservoir is full there is still the pressure of the soil at the back of the walls, but counteracting this is the water pressure from within. It is therefore desirable that walls of this class shall have reinforcement on both sides, and not in the centre of the wall, as had the reservoir which failed at Mittagong, N. S. W.

(b) **Reservoir Partly Out of Ground.**—These are known as the cantilever type. In determining the width of the heel we must remember that in an ordinary retaining wall the weight of the earth at the back of the wall would help to keep the wall from overturning, but with a reservoir the weight of water should be disregarded. The heel should therefore be made of sufficient width and thickness to be stable when the weight of water above it is neglected. One of the most important things to be careful with in designing a reinforced concrete reservoir is the arrangement of the bars at the joint between the vertical wall and the footing.

(c) **Reservoirs Out of Ground.**—These will be similar in design, but buttresses are usually added. The wall acts as a dam to withstand water pressure.

Reservoir Roof

The reservoir roof often acts as a tie, and holds the reservoir walls together; the reinforcement is therefore arranged accordingly. When the span is large, however, the elongation may be considerable, and it is then not advisable to tie the walls in this way, but to give the roof free sides for expansion.

An Interesting Experience with Cement Floors

FOR a long time the Chief Trade Instructor of th Dominion Government Penitentiary at Edmonton, Alberta, was sorely perplexed because of the way in which certain portions of the cement floors in the institution were wearing away. Restless convicts who were given to pacing to and fro in their cells wore deep depressions in the cement. In the corridors, too, the floors showed very noticeable wear after they had been used only a few months. Every time the floors were swept, large quantities of sand were gathered up, and the dust in cells and corridors was very obnoxious. The Chief Trade Instructor had superintended the mixing of the concrete and the laying of the floors; and he knew that the fault lay not in the quality of the cement. Try as he would, he could not account for its apparent softness. One day, not long ago, the Chief passed through the corridor of the main cell block when the convict cleaners were scrubbing the floors. He noticed that they used a very strong solution of creosote for cleansing and disinfecting, pouring it ahead of them with their brooms. Suddenly it occurred to him that perhaps it was this creosote that was playing such havoc with his perfectly good floors. He resolved to experiment, and made two plates, of the same proportion of sand and cement as was used for the floors. One of these he treated with creosote diluted in water, administering the mixture several times during the day with a brush. The other plate was left untouched. The following day he took up the two plates, and with his knife was able to scrape off large quantities of sand and cement from the surface of the plate that had been subjected to the creosote. In fact, it was so soft that one could make holes in it with a sharp stick. The other plate was, of course, hard and in perfect condition. Needless to say, the use of creosote as a cleanser and disinfectant for the cement floors and walls was abandoned immediately.

An architect figures as the chief character in the Russian dramatist Leonidas Andreiev's play. "The Life of Man," which has been produced at the Lyceum Theatre, Edinburgh, for the first time outside Russia. It is not a cheerful play. Briefly, the dramatist endeavors to recount the life of a man from cradle to grave in an atmosphere highly charged with symbolism and thickly populated with mysterious Hims and Its. Before the man is born, Life speaks his prologue. During the process a group of old women mow and chatter and cynically chronicle the travail of the mother. As the child is born a candle is lit—in due course to be snuffed—in the hand of Life. The Man's life follows thereafter in four stages. In the first he is living on love and dreams with a charming wife, while he fails to "arrive" as an architect. This lovemaking is described as quite the best thing in the play, for its beauty is heightened by the brave challenge of Poverty and Destiny which breathes through the young people's talk. In the next stage the Man has "arrived." But his success and the cringing suitors who chase love from his home are rather sketchily drawn. Andreiev is happier in showing the return to poverty, through a change in the popular taste in architecture. Henceforth he piles up calamity with characteristic ardour. The Man's only child dies, and he himself becomes a dipsomaniac. The last stage shows his end in a delirious death-bed.

Prince Rupert's Great Floating Dry Dock, Now Nearing Completion

COMMENCED in April, 1912, it is expected that the Grand Trunk Pacific floating dry dock at Prince Rupert, B.C., will be finished in September or October next. The port has made great progress of late, and there are now three first-class rail services a week from Winnipeg to Prince Rupert. Doubtless this development will be still more marked when the dry dock is completed. The dock is being built by the Grand Trunk Pacific Railway Company at an estimated cost of $2,500,000.

The land and wharf area is 17 acres. The dock is in three units, the extreme length of the dock over all being 600 feet, with a lifting capacity of 20,000 tons. The middle section is 270 feet long, with a lifting capacity of 10,000 tons, and the two end sections are each 165 feet long, with a lifting capacity of 5,000 tons each. In addition to the units with steel wings, there are twelve wood pontoons. The latter are removable and self-docking. This feature allows of the use of two or more pontoons for salving wrecks, under certain conditions, or enables three ships to be docked at once, as each section works independently. The combination of wooden pontoons and steel side walls or wings is believed to furnish the most durable, as well as the most economically maintained, floating dock. The pontoons being wet all the time, the timber lasts indefinitely, unless attacked by marine borers, but this danger is carefully guarded against. The wings, being wet and dry alternately, must be of steel. The pontoons are of lumber, sheathed with four layers of felt, a layer of galvanized sheet iron, and an outer layer of creosoted planking. Each layer is swabbed with a mixture of pine tar and arsenic, which makes it safe against toredo.

The entire dock, which has a draft of 30 feet over the blocks, can be pumped out in one and a half hours. The plant is equipped with the most modern machinery, including on the dock three air compressors of 500 cubic feet each, and twelve 24-in. centrifugal pumps, electrically driven. The ship shed is equipped with two 10-ton travelling cranes. A fifty-ton shear leg derrick is on the dock, and can be used for handling boilers and heavy machinery in and out of ships.

The power house, which is 104 x 148 feet, is constructed of steel and concrete, and contains two 1,000 kw. turbine generators and a large air compressor. A system of underground electrical conduits has been installed throughout the shipyard, as well as compressed air lines. About 2,600 h.p. will be developed. The power house will contain six 400 h.p. water tube boilers supplied with automatic stokers, chain grate type, such as are known to give satisfaction with Pacific Coast coal. The air compressor (steam driven) is of 1,500 cubic feet capacity.

Besides the dock proper and the power house, there are foundry, 75 x 150 feet; machine shop, 75 x 150 feet; boiler and blacksmith shop, 75 x 150 feet; shipbuilding shed, 160 x 300 feet; side launching platform, 440 x 80 feet. The chimney on the power house is 175 feet high by 11 feet diameter.

G.T.R. dry dock at Prince Rupert, B.C., showing pontoons 10, 11 and 12 under construction, under shipbuilding shed. Each pontoon is 130 feet long. Note the 80 ft. overhang of shed, which carries two 10-ton travelling cranes, electrically-operated.

Each shop and the power house is equipped with a 15-ton electrical overhead crane, while the ship shed has wood-working machinery, and also overhead cranes arranged to build vessels under cover over permanent launchways.

The following is a list of the machinery in the machine, boiler and blacksmith shops:—Pond engine lathe 76 ins. x 62 ins., engine lathe 42 ins., double

General view of the Prince Rupert dry dock.

G.T.R. dry dock at Prince Rupert, B.C., showing a portion of the middle section of floating dry dock under construction. Its lifting capacity will be 20,000 tons.

angle shear, engine lathe 26 ins. D.B.G., heavy vertical drill 30 ins., tool makers' lathe 16 ins. x 10 ft., Cox pipe threader 6 ins., style "F" Yankee Drukk grinder, Acme single bolt cutter 2 ins., 4 Fisher & Morris anvils 300 lbs., 4 sets B.S. hand tools, 2 LeBlond B.G. engine lathes 18 ins. x 10 ft., Arm Mouller radial drill 3 ft., Niles horizontal milling machine, Niles boring mill 10 ft., LeBlond No. 4 Universal milling machine, planer 72 ins. x 72 ins. x 20 ft., B.G. crank shaper 24 ins., Universal radial drill 6 ft., No. 3 single punch, No. 3 single shear, vertical drill 25 ins., plate planer 16 ft., 4 Buffalo Forge No. 0-C, double punch and shear No. 6, Niles flanging clamp 14 ft., S. F. steam hammer 1,200 lbs., and set No. 4 Niles bending rolls.

The material used in the construction of the dock was:—Lumber in 12 pontoons, 4,000,000 feet; galvanized fastenings in pontoons, 400 tons; weight of each pontoon, 490 tons; lifting capacity of each pontoon, 1,700 tons; bolts and spikes, 360 tons; steel in wings of dock, 2,400 tons; rivets in dock, 500,000; white pine wedges for caulking pontoons, 800,000; paint on wings of dock, 13,000 gals.; fireproof roofing, 130,000 sq. ft.; lumber in wharf, 3,000,000 feet; piling in wharf, 268,000 lin. ft., and filling in yards, etc., 303,000 cu. yds.

By August 1st next the dock will be in a position to use a portion of the plant including the 50-ton derrick, machine, boiler, shipbuilding shops, and foundry, and enough of the floating drydock to handle a ship 450 feet long of any tonnage.

The engineers who designed the dock and who are in charge of construction are Messrs. Frank E. Kirby and Wm. T. Donnelly, of New York, with Mr. J. H. Pillsbury, of Prince Rupert, B.C., acting as their local representative on the work. Mr. Chas. N. Crowell, of Prince Rupert, is general manager and superintendent of the drydock.

G.T.R. dry dock, Prince Rupert, B.C., Administration building completed.

Removing Stains from Stonework

IN the first place, it cannot be insisted upon too strongly that no stone now accepted as a standard in the market contains within itself the elements of staining or discoloration. It may change its color somewhat in weathering, but this will be in the way of a mellowing of tone, and will give no unsightly blotches. This is proved by the natural exposure of the rock in the quarry. Where there is staining in the walls of a building, it can safely be set down to faults in the setting, or to some cause extraneous to the stone itself.

The most prolific source of trouble, says a writer in "Stone," is, of course, the cement that is used in setting the stone. Ordinary Portland cement will badly stain almost any stone. Various so-called "non-staining cements" are widely heralded, but it is the universal experience of stonemen that little dependence can be placed on these. In the old days, before cement was so widely used, architects rarely had to complain of staining. There are thousands of buildings that have stood for half a century or more that show only the kindly mellowing of time, save for the effect of smoke and dust incidental to city life.

Architects will specify very particularly that stone be set in cement mortar and think that they guard against all trouble if they require the back and sides of the stone to be coated with waterproof paint. Undoubtedly a good paint is much protection, but the difficulty is to coat the beds and joints of each stone clear to the face. A narrow strip left unpainted will permit the carrying of the discolorating moisture from the cement to the face of the stone by capillarity.

All of this trouble could be avoided if the architects would only insist that the stone be set entirely in lime mortar, made in the following proportions: one part lime and three parts sand. The lime to be thoroughly slaked and the sand well tempered; all mortar to lie in the pile at least twenty-four hours before using; all sand to be clean, coarse, and free from loam. If the most delicate stone is set in mortar as above, and the back of the stone plastered with the same mortar, it positively will not stain. There is another way in which stone may be stained—by the drippings from concrete floors or roofs. In such cases the discoloring moisture runs down the face of the stone, and no painting of the back or beds can afford any protection. The utmost care in superintending the construction is the only safeguard from this disfigurement.

Cement stains cannot be eradicated by any wash or other treatment. Fortunately, they are apt to bleach out in time under the influence of the sun and the weather. The architect and the owner alike are naturally greatly exercised when cement stains appear, and try to seek some immediate remedy. The only thing to do is to have patience and wait for the natural bleaching, which may take weeks or even months. The stone setter, anxious to leave a building in spick and span condition, may suggest that it be washed down with muriatic acid. This should never be permitted. The acid may take out some of the stains for the moment, but it burns the surface and eventually will discolor even those portions that escaped the original staining.

There was a time when scrubbing with wire brushes was permitted, but this has generally been discarded, since its bad effects have been recognized.

It is impossible to use wire brushes without leaving a coating of iron on the surface of the stone, and this is bound to leave a worse stain than it corrects.

The sand blast is sometimes employed, but generally for old buildings that have become discolored from smoke and soot. This method should always be discouraged. The sand strikes the stone with a tremendous impact. It destroys the "skin" which forms on the surface of the stone by deposition of mineral ingredients on the evaporation of the interstitial water. It also stuns the grains or crystals of the stone and tends to hasten the weathering.

The very best treatment of stone to remove smoke, soot, dirt, mortar, etc., is a simple washing. A recipe that is recommended by stonemen of the widest experience is as follows: prepare a wash of soft water and about one and one-half bars of common laundry soap. Boil until the soap has been thoroughly dissolved. Add a fine, clean, gritty sand (white preferred) and mix to about the consistency of putty. While mixing add about five tablespoonfuls of ammonia to a bucket of water. With this preparation scrub the surface with a stiff scrubbing brush, wash down with a stream of water from a hose, and then go over it again with a scrubbing brush.

While any building may need a cleaning, a great deal of the staining could be avoided if more care were taken. While speaking of the evil effects from cement and the dripping of dirty water, there are other things to be guarded against. The rust from improperly protected iron or steel and the verdigris from copper or bronze sheathing have disfigured many a fine structure. The writer knows of one very costly building where the oil-saturated exhaust steam from hoisting engines was discharged directly against the facade. What wonder if this is permanently stained? Doubtless the architect is speculating as to the cause of the discoloration, and is inclined to blame the stone.

The Design of School Buildings, with Special Reference to the William Whyte School at Winnipeg

Specially contributed by Col. J. B. Mitchell, Commissioner of School Buildings, Winnipeg

THE planning of modern public schools has been standardized probably to a greater extent than any other type of building, but the programme of school routine (which may vary in each community) really determines its general layout. The location of offices, toilets, etc., the connections and the grouping of special departments, become more or less automatic. In Winnipeg, the conditions which the School Board has had to face for several years—that of providing accommodation for an annually increased attendance of over ten per cent. (reckoning in accurate daily averages as shown by the rolls), has resulted in the adoption by the Board of certain definite principles in regard to the planning of new schools. During the past year, three splendid new schools have been added to Winnipeg's list. These buildings are of the most approved design—both in regard to construction and equipment, and testify to the established policy of the Board to provide the best of everything for educational purposes.

The class rooms are designed to accommodate a maximum of fifty pupils, and follow the same general scheme in all schools. They range in size from 25 ft. x 33 ft. to 26 ft. x 35 ft., according to the size of desks which are to be used, senior classes requiring the larger desks, individual desks being used. The door is always at the right-hand front corner of the room, near the teacher's desk, and a 4-ft. wide wardrobe, for the children's clothes, runs across the rear of each room. Access to this wardrobe is only provided from the class room through arched openings, one at either end. There is no door communicating directly with the corridor. Blackboards of best natural slate extend along the front and right-hand walls. The rooms are so arranged that the light enters over the pupil's left shoulder, and generous transoms of prismatic glass carry light to the side of the room remote from the windows. Artificial light for evening work is provided by sixteen 40-watt bowl-frosted Tungsten lamps, evenly distributed over the entire ceiling area, and controlled by two separate switches, thus giving two intensities of illumination. The floor heights are uniformly 12 ft. 10 ins., which allows two equal flights of eleven 7-in. steps between floors. The main corridors are of liberal width, approximately fourteen feet wide.

Every possible precaution is taken against fire, no wood entering into the construction of the school, other than window and door frames and interior trim. The bearing walls are of brick, the partition walls are of metal lath and plaster, and all floors are of reinforced concrete. Access to the different floors is provided by iron staircases enclosed in fireproof stairhalls, which are separated from the main corridor by copper-covered firedoors, with wire plate glass panels, and transoms. The roof is of slow-burning mill construction, on steel trusses, and is covered with asbestos shingles. When buildings are three storeys in height, two metal spiral fire-chutes are provided, one on either side of the building, the doors to which, on each floor, are fitted with anti-panic bolts, red lights in the corridors indicating the fire exits. Two fire-hose cabinets are located on each floor in a prominent place ready for instant use.

Among the most important sanitary features of Winnipeg schools are the floors, which are of jointless composition throughout, a cove base of the same material carrying eight inches up the wall in all cases. In the toilet rooms, this base is continued to a height of five feet, thus forming a smooth, clean dado. There is practically no place in the building where dust can collect. All the doors are of the flush veneer "slab" type with trim on only the class-room side of the openings, the jambs and soffits elsewhere being bullnosed to die on the frame which is finished with a suitable mould. Metal picture mould, finishing flush with the plaster, is installed wherever desirable.

Lavatories and toilets for both boys and girls are distributed in the basement and on the second floors, while those for use of teachers are in private rooms off the offices. The toilet fixtures include wall-outlet and floor-outlet water closets, operated by flush valves, and individual porcelain urinal stalls, which are of the upright type, with floor outlets, and are provided with concealed metal flush tanks of 4-gallon capacity, arranged to flush automatically every three minutes.

All fixtures are separated by means of slate partitions on metal framing, and are locally vented by exhaust fans. Porcelain hand-bowls, with self-closing cocks for hot and cold water, are installed, and in the basement are located shower baths for both sexes. On each floor are two drinking fountains, each with four outlets—controlled by push buttons.

Besides lighting and power, the electrical contract calls for a complete system of clocks and bells operated from a central station. The master clock, which is situated in the lower halls, is equipped with a pilot clock, which controls all the secondaries, and with a programme to operate the bells which announce the periods for all lessons, races, lunch hour, etc., during the day. The Principal's office has telephonic communications with all the rooms, but there is no intercommunication between the rooms.

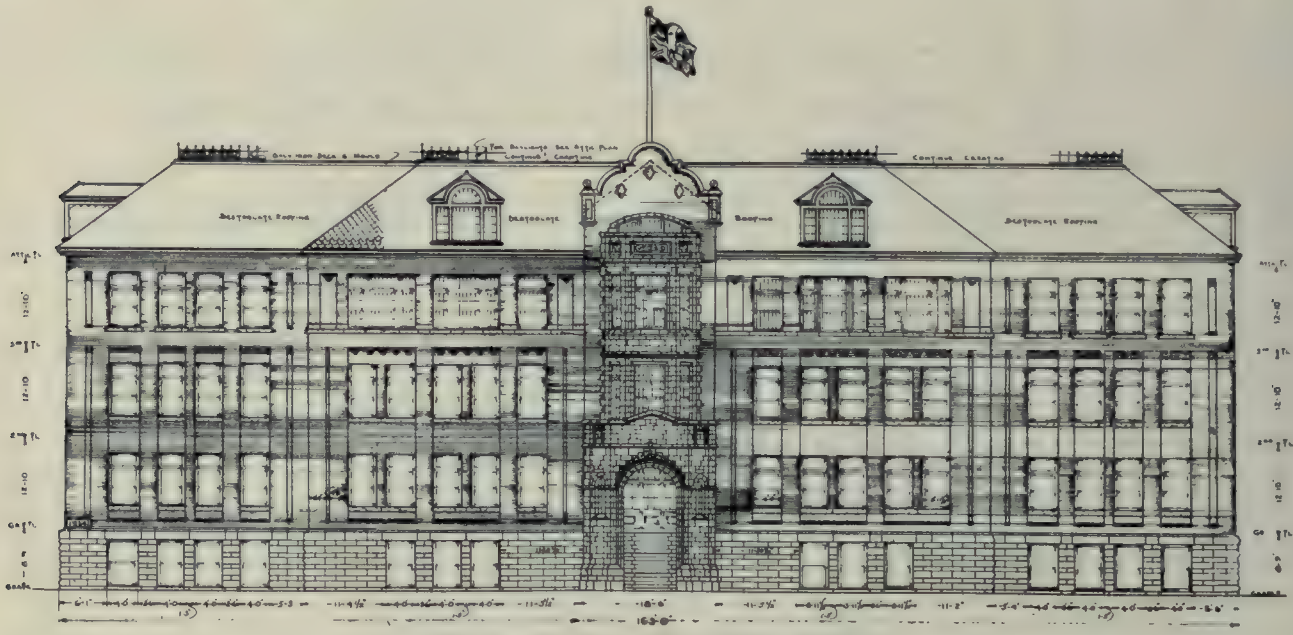
For convenience and thoroughness in cleaning the building, a two-sweeper vacuum cleaner, of the rotary-valve type, with wet separator, is installed. Electrically driven by a 7½ h.p. motor, this machine has capacity to exhaust 40 c.f.m. of air from each outlet (the hose being attached) while maintaining a vacuum of 12 inches mercury. Compressed air may be generated by reversing the action of the motor through a two-throw switch. An "unloading" device, which compensates when only one sweeper is used, ensures the economic operation of the plant.

All rooms are warmed and ventilated by fresh air taken directly from the outside, which is first tempered by being passed through heating coils, then washed by passing through the air washer, then through the reheating coils into the fan, whence it is distributed equally to the rooms. The heat in the rooms is supplemented by direct steam radiation. The steam is generated by two low-pressure boilers, with gravity return. Condensation in the case of basement radiation and the heating coils is drained into a common receiver fitted with a float switch operating a motor-driven pump, which returns the condensation to the boilers.

An automatic thermostatic system is connected with and controls the temperature of the coils and radiation. The roof dampers, which control the escape of all vitiated air, are opened and closed by the same system. Exhaust fans take care of all foul air from the toilets and lavatories.

Steam is not used as the motive power for the different apparatus, for two reasons. In the first place electric current in Winnipeg is very cheap, and secondly, high pressure plants are not operated as economically as low-pressure, and a low-pressure system would not drive machinery. There are no register faces on the outlet vent openings which are at floor level, but the floor and base are carried into and around, and the wall above is plastered and painted exactly like the dado in the room. With this arrangement, the presence of any dirt is at once apparent, and there is no difficulty whatever in removing it entirely. In all cases the heat openings are located near the ceiling and have vertical deflectors of galvanized iron, covered with a mesh wire guard, all painted to match the wall of the room.

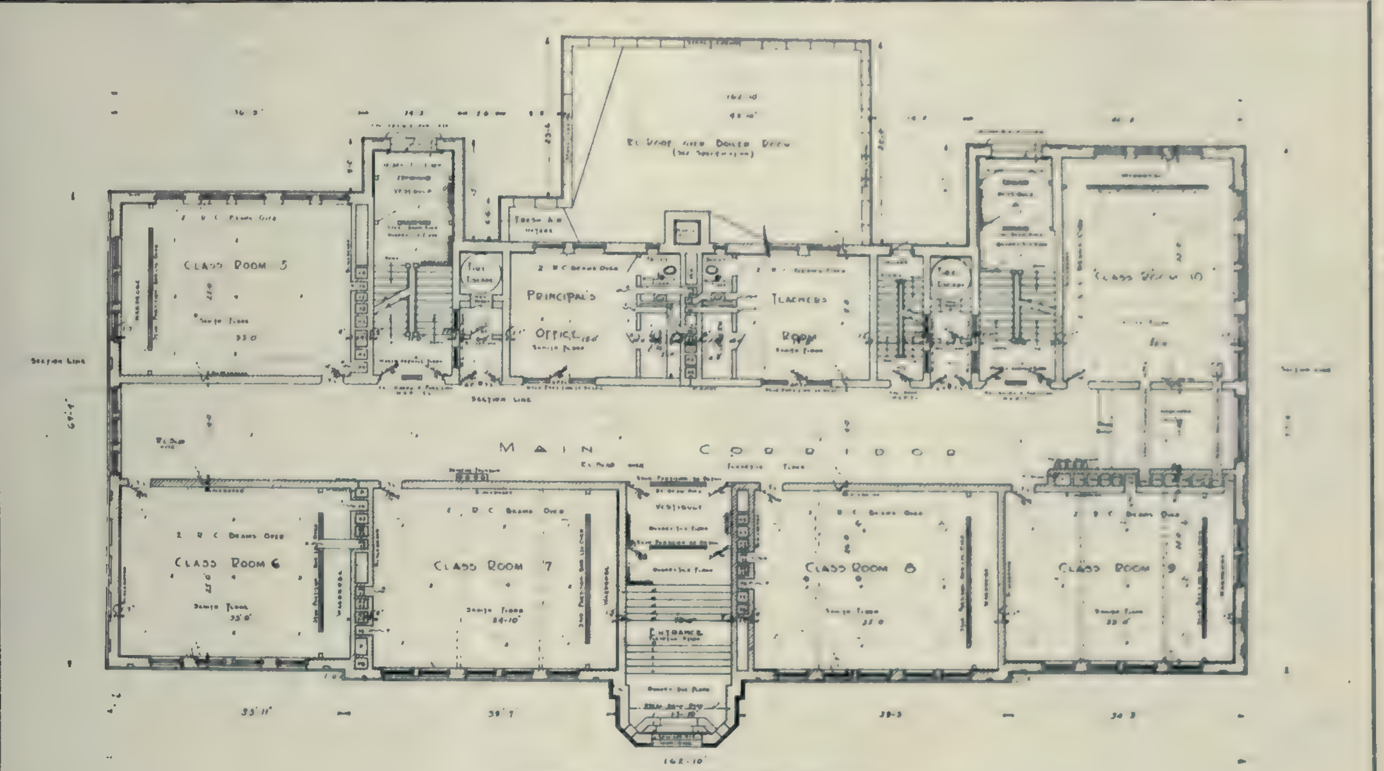
The total accommodation provided by the three new Winnipeg schools is as follows:—King Edward No. 2, 1,000; William Whyte, 1,000; Earl Grey, 1,500; total, 3,500.



Front elevation, William Whyte School, Winnipeg.

Of these schools the William Whyte (while following the general principles of design described above) has several particularly attractive features. In plan it is practically rectangular, measuring 164 feet by 65 feet. The cornice at the attic floor level is 50 feet above the finished grade line. The three upper floors are faced with buff sand-lime brick of local manufacture, laid up in red mortar, and rest on a 9-ft. plinth of rock-faced Tyndall stone (in alternate wide and narrow courses) which forms the basement storey. All exterior walls are lined with hollow brick on edge, and are waterproofed below the grade by cement and "Ceresit." Stone is also used for window sills, belt courses, and other exterior trim, in which capacity it harmonizes with the general color scheme and relieves the monotony of any large wall surface. The pitch roof, which forms the attic, is bell-shaped, covered with gray asbestos shingles laid "diamond pattern" and finished with a substantial cornice projecting two feet from the wall.

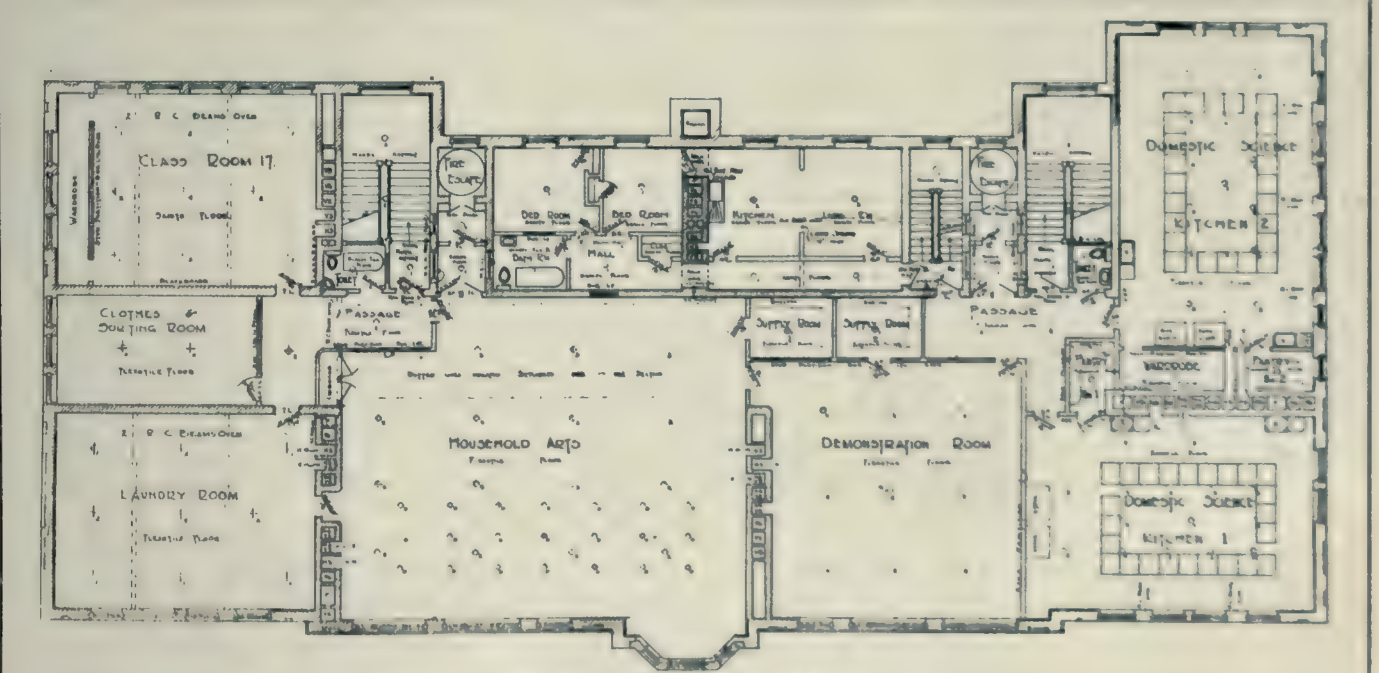
The interior walls and ceilings are plastered and covered with waterproof paint on the upper floors. In the basement special damp-resisting paint is used.



Ground floor plan, William Whyte School.

The whole has an "egg-shell" finish. The ceilings are white, softened with the merest suggestion of green, so as to reflect the light without offending the eye. The upper walls are a light cream, and the dado, which is in constant danger of being soiled, is made quite dark—green in most cases. These colors were selected as being the most practical to use, in view of the danger of "burning," which invariably manifests itself in new walls. The floors are light brown in the centre, with a border and base of rich warm red, which reaches up to the green of the dado. The rather dark fumed effect of the oak trim harmonizes with the general scheme.

In addition to the seventeen rooms where regular classes are conducted, there are special departments for girls, located on the third floor, where they do not interfere with the rest of the school, and where they are easily accessible to the older pupils and to pupils from outside schools. This special unit includes two domestic science kitchens of twenty-four tables each, equipped with individual gas cookers, besides gas and electric ranges, a large sewing room—including one



Third floor plan, William Whyte School

hundred and twenty individual lockers, a demonstration apartment for instruction in household management, together with a laundry having twelve tubs, ironing boards, mangle, clothes drier, etc.

In accordance with the Board's policy regarding the larger schools, a caretaker's quarters has been provided on the third floor. This apartment has a separate entrance, and separate stairs, and is equipped with an electric clock, a telephone to the principal's office, and a vacuum cleaner outlet similar to the rest of the building.

The total cubic contents of the building are 884,650 cubic feet. The contract price, exclusive of heating and ventilating, was $121,640, and the cost of erection worked out at $13.75 per cubic foot. The contract for heating and ventilating was awarded at the figure of $16,570, and worked out at $1.87 per cubic foot. The total unit cost was $15.62 per cubic foot.

Dealing with these figures in another manner, the total cost, including heating and ventilating, was $138,210. Twenty-four rooms, costing $138,210, worked out at $5,759 a room, and, with fifty pupils to a room, at $115 a pupil. Five per cent. of this $115 gives an annual cost of $5.75 per pupil for accommodation.

These prices compare favourably with those for schools of a similar type erected elsewhere in Canada and the United States. In Boston, twenty-two buildings average a unit cost of 22 cents per cubic foot, and in St. Louis eight schools show an average cost of 17½ cents. Similar buildings in Montreal cost about 20 cents per cubic foot.

In conclusion, may I be allowed to express the opinion that no public money spent in Canada is productive of such beneficial results as the money spent in providing the girls and boys of to-day (who in a few years will be guiding Canada's destiny) with a proper education. In this, first-class school buildings have an appreciable effect.

Gravel is about the only hard-surfacing road material Iowa has, and an experimental two-course water-bound road 1¼ miles long of that material will be built this year in Webster County just east of Fort Dodge. The road is for the purpose of testing out the gravel along modern lines to meet hard-surfacing conditions. It is to be a joint affair participated in by the city, county, State Highway Commission and good roads section of the Engineering Experiment Station at Iowa State College. The road will be 16 ft. wide, 8 ins. thick in the centre and 6 ins. at the sides. Frequent tests will insure the proper proportions of gravel and clay binder. A coat of oil will probably be applied one or two months after construction has been completed.

At the recent sitting of the Dominion Railway Board in Vancouver an application was made for an order directing the Vancouver, Victoria & Eastern Railway to commence the construction of freight and passenger terminals on False Creek, as provided for in the agreement entered into between the city and the railway company on May 16, 1910.

Amendments recently made to the building bylaws of the city of Victoria effect a substantial restriction in existing fire limits, and also the right to effect repairs. Hereafter new work on a building damaged by fire within the fire limits will be limited to 25 per cent. of the value of the structure.

The Use of Large Stone Chips in the Maintenance of Bituminous Roads

THE Maryland Highway Commission, of which Henry G. Shirley is chief engineer, after an experience with the maintenance of bituminous roads extending over several years, has (says our Chicago contemporary, Engineering and Contracting) adopted the practice of using stone chips at least 1 in. in size. The chips are spread over the surface of the road, at seasons of the year when the bitumen is soft, in an even layer one stone thick, and rolled. The rolling forces the stones into the surface of the road until they are flush with the pavement. When completed the surface has somewhat the appearance of a mosaic. Hard blue limestone is used, and has been found to be quite satisfactory for this purpose.

The reason for the method of maintenance adopted is obvious. It has been universally found in practice that small stone chips are either quickly ground to a powder by iron-shod traffic or are in a large measure swept from the road surface by automobile traffic. The use of sand is now quite generally avoided by maintenance engineers, on the ground that it tends to build a mat or pad that becomes unmanageable when thick, and also greatly increases the danger of waves in the pavement due to the pushing of the bituminous surface occasioned by the continual passage of automobiles, usually travelling in a single direction on one side of the road.

While this method of surface maintenance—or, more properly, surface improvement—is not new from an experimental standpoint—similar work having been done by Major Crosby, the former engineer for the commission—its application to road maintenance work on a large scale, such as is in progress in Maryland, is an innovation. From the standpoint of the road user it possesses advantages. The exposed stones roughen the surface and reduce the slipperiness of the pavement. Slipperiness has always been a fault of biutminous treated country roads, especially since many of the horses that travel them are not sharp shod. The danger of automobiles skidding is also reduced. From the standpoint of increasing the life of the road the reduction in slipperiness permits the use of a relatively higher crown, thereby insuring thorough drainage of the surface and increasing the durability of the road, the practice of most road engineers being to use as much crown as limiting conditions will permit. In this connection it may be said that experience has demonstrated in the city of Washington that asphalt streets and roads built with a high crown have usually a longer life than those streets or roads on which less crown is used.

While the labor cost of applying large stone chips in this manner is necessarily increased somewhat, the road surface is improved by the thorough ironing out it is given by the roller. The greater availability of the supply of larger stone is also a factor worthy of consideration in many sections of the country. It is frequently difficult to secure an adequate supply of ½-inch and ¾-inch stone.

It is believed that the incorporation of large stone chips into the surface of the road is worthy of the consideration of engineers engaged in both maintenance and construction work. While difficulties are encountered and careful workmanship is required, the results obtained are of sufficient value to warrant the additional cost.

The Dominion Observatory, Little Saanich Mountain, Victoria, B. C.

THE building and dome to contain the great 72-inch reflecting telescope, which is to be located near Victoria, B. C., is to be built entirely of steel, cased inside and out with sheet metal. There is to be a continuous passage between these inside and outside coverings to allow for the circulation of air, the entrance being through openings at the bottom of the building and the exit through louvred openings at the top of the dome. The purpose of this ventilating between the walls is to keep the middle of the dome during the day at the shade temperature, thus preventing the heating of the interior and the disturbance of the form and definition of the mirror by great changes of temperature. The purpose of constructing the building and dome entirely of metal is to allow the whole surrounding of the telescope to rapidly attain the air temperature after sundown. Otherwise, the definition of the star images is seriously affected.

The building is 66 ft. in diameter and nearly 75 ft. high, the centre of motion of the telescope being about 40 ft. above the ground. The dome is revolved by electric motor, and the entire handling of the telescope, whose moving parts weigh 40 tons, is also performed by electricity; seven motors and numerous electric clutches being required for this purpose. The shutter opening is 15 feet wide, extending 6 ft. beyond the zenith. An electrically operated observing platform, to enable the upper end of the telescope tube to be reached in any position, moves up and down in the shutter opening. Blinds or wind screens are also provided, moving up from the top to prevent the shaking of the telescope by the wind.

"Don'ts" in Rock Excavation

THERE seems to be a tendency among shovel men, when digging rock, to make the shovel "bite more than it can chew," in other words, to try to force as big a move as possible. This is a mistake for several reasons.

In order to make an extreme move it is necessary to dig with the handle run out practically to the end. In rock work the twisting stresses are great and although a shovel will stand up to it for a while, a breakdown is very probable, due to the strains caused by hard digging in this position.

A shovel does not exert its maximum power with the dipper run out as far as it will go. Furthermore, there is much more strength when the dipper is kept in as far as possible.

When an operator tries to stretch things and make a big move he often gets the front of the shovel so close to the face that in attempting to get the dipper back he will frequently batter the front end of the car-body to pieces, pound the circle, and often cut the swinging cable.

Don't try to make too big a move in rock work.

Don't run the shovel up too close to the new face.

Don't dig with the handle run out to its end.

Saving in one way sometimes involves expense in other ways that more than offsets the prospective gain. The president of a prominent construction company states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column. On the other hand, the increase in form cost was $5.70 per column, entailing a loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size columns on successive floors than to reduce the dimensions. One way to avoid frequent changes in column sizes is to vary column reinforcement in successive storeys.

Personal Mention

Mr. W. S. McGibbon has been appointed Town Engineer of Transcona, at a salary of $2,000.

Mr. Frank McArthur, City Engineer of Regina, has been appointed City Engineer of Guelph, at a salary of $2,500 a year.

Mr. W. R. Butler, for the last eighteen years Professor of Civil Engineering in the Royal Military College at Kingston, Ont., has retired from active service.

Mr. F. L. Brinkman, formerly Assistant Engineer of the city of St. Thomas, Ont., has been appointed Assistant Resident Engineer in the Department of Public Works at Fort William, Ont.

Mr. Rudolph Hering, of Chicago, paid a visit to Victoria recently, after a tour of the San Francisco Exposition. It is recalled that as long ago as 1891 Mr. Hering was called in by the city of Victoria to report on the trunk sewerage scheme.

Mr. Hurlbut S. Jacoby, formerly Chief Engineer of the Standard Steel Construction Company, of Welland, Ont., and recently appointed Instructor in Civil Engineering at Pennsylvania State College, has been retained as Associate Engineer for summer work by the Samuel Austin & Son Company, industrial engineers and builders, of Cleveland, Ohio.

Mr. C. H. Mathewson, engineer in charge of the harbor improvements now being carried out at Toronto by the Dominion Government, was presented with an electric lamp and a gold fob by the sub-engineers and inspectors employed on the works at a meeting of the South Toronto Conservative Club, Simcoe Street, last week. The lamp was made from the first piles driven, and the fob was modelled to represent a "pile." Mr. Mathewson succeeded Mr. J. G. Sing as engineer in charge of the work, he having been promoted from the position of senior assistant engineer.

Book Review

Manual of Surveying for Field and Office, by Raymond E. Davis, C.E., Instructor in Civil Engineering at the University of Illinois. Published by the McGraw-Hill Book Company, Inc., New York City. Price $2.50.—This book is a manual of the practice of surveying designed for the use of civil engineering students in their preparation for field and office exercises. Primarily it is intended for use in conjunction with a treatise on surveying if the field and office practice is developed with the theory, or for use alone if practice is given after the theory has been studied. The book is also adapted for use in short elementary courses in surveying, in which the time devoted to field and office work is comparatively long, such as the courses usually given to mechanical and electrical engineering students. The aim in the preparation of this volume has been to provide an efficient means of teaching students the proper use of surveying instruments, the proper procedure in making surveys, and the proper methods of computing and mapping. The practical phases of the subject are discussed in great detail.

Mainly Constructional

East and West — From Coast to Coast

The corporate name of the Montreal Paint and Glass Company, Limited, has been changed to C. A. Sharpe, Limited.

Creditvale Works, Limited, is a new machinery manufacturing firm to receive a charter. The concern is capitalized at $100,000, and the head office will be at Toronto. G. W. Hammond, patent solicitor, of Toronto, is one of the incorporators.

The Vacuum Street Cleaning Machine Company, Limited, of Windsor, Ont., has been incorporated with a capital stock of $175,000. The company will carry on the manufacture of street sweepers, cleaners and dusters, air cleaning and drying apparatus, and all incidental machinery. The incorporators include W. T. Blaney, of Windsor, Ont., G. S. Clarke, and J. A. Corrick, both of Detroit.

The Page-Hersey Iron, Tube & Lead Company's plant at Guelph, Ont., which has been running short-handed for some time, is starting up again with a full staff. The number of men employed has been about forty, but this is now being increased to one hundred and fifty. The company will manufacture the same line of iron pipe as formerly. It is stated that they will also operate a galvanizing plant.

The Missisquoi-Lautz Corporation, Limited, Montreal, have the following contracts in hand: marble and tile for the Ottawa Examining Warehouse, of the value of $76,500; marble for the St. Denis Theatre, Montreal; for the Redemptorist Church, Quebec; for the Post Office, St. John, N.B. The company's marble is also specified for the Montreal civic library and for the new C. P. R. station at Quebec.

An early start will be made on the new railway terminals at Toronto, according to information from Ottawa. It is stated that an arrangement has been made for advances of $4,000,000 by the Bank of Montreal on the guarantee of the Canadian Pacific and the Grand Trunk Railways, and that all details have been worked out, including the arrangement with the Government in regard to the question of a postal station. Contracts for the work were awarded about a year ago, but the financial disturbance created by the war necessitated a postponement of all arrangements, including those relating to financing. The P. Lyall & Sons' Construction Company was the successful tenderer for the larger portion of the work.

The New Toronto Council have definitely decided to link up with Mimico and construct a sewage system and disposal plant which will accommodate the needs of both municipalities. The disposal plant will be built in Mimico. The pumphouse, a portion of the new works, will be constructed at the lower end of Superior Avenue. The cost of the new system will amount to about $50,000, according to the estimates of the engineers. Of this amount New Toronto will contribute half. No time will be lost in starting operations. It is hoped to have work in full swing by the middle of next month. According to the present plans part of the New Toronto system will be utilized and all sewage will drain to the Lake Shore Road, where a 36-inch main will connect with the plant at Mimico.

Work is progressing rapidly on the various stretches of highway now being built by the Good Roads Commission, and gangs are now engaged reconstructing Main Street, Weston; Main Street, Stouffville; the Kennedy Road through Agincourt, Unionville and Stouffville, and the Vaughan Road in Fairbank and Downsview. Workmen have been busy resurfacing Main Street, Stouffville, and Mr. E. A. James, the Engineer, expects to have the new road open for traffic right away. A new road has been laid on Main Street, Weston, from the southerly limits to Mill Street, and the road will be finished in about three weeks. On the Kennedy Road about four miles of new road is being built at a cost of $35,000. About one and three-quarter miles is being constructed on the Vaughan Road at a cost of about $10,000.

The Public Service Corporation of Quebec is the name of the new hydro-electric company recently incorporated with a provincial charter to supply light and power to the cities of Quebec and Three Rivers and to operate in several adjoining counties. The corporation have, through Mr. C. H. Branchaud, of Montreal, purchased by public auction for $100,000 the assets and contracts of the Dorchester Electric Company, and have contracted with the Shawinigan Water and Power Company for the latter to supply all the power needed. This will involve the building by the Shawinigan Company of a transmission line to Quebec, and it is expected that it will be completed early in the fall. It is intended to overhaul the present steam plant of the Dorchester Company and to use it as an auxiliary. The provisional directors of the Public Service Corporation of Quebec are—Messrs. Howard Murray, T. McDougall, and Julian C. Smith, of the Shawinigan Water and Power Company, and C. H. Branchaud and Milton L. Hersey, directors of the Dorchester Company.

According to information furnished by Mr. J. S. MacLachlan, Superintending Engineer of the outer harbor improvements at Victoria, B. C., the month of June was a record-breaking one in connection with progress made on the breakwater. The wall was completed for an additional distance seaward of 150 feet. The undertaking is being carried out in good order, and by the end of the year the structure will be completed. During the month the contractors for the breakwater, Sir John Jackson, Limited, dumped 24,713 tons of rubble, laid in position 8,815 tons of granite rock, and set 2,042 cubic yards of granite. The total returns since the commencement of the work are as follows: amount of rubble dumped, 659,154 tons; amount of granite laid, 51,228 tons, and amount of concrete set, 11,942 cubic yards. June was a record month for the laying of granite and the setting of concrete. Six blocks of concrete, each block weighing 700 tons, were completed, and this increased the length of the wall 150 feet. Grant Smith & McDonnell, contractors for the new piers, have made good progress. In the dredging operations 16,416 cubic yards of material were removed, a total of 5,330 tons of rubble was dumped and a surfacing of 1,617 cubic yards was deposited. On the cribs 679 cubic yards of filling was used, and 21,607 cubic yards of material for the back of the cribs was set. This brings the total amount of rubble dumped since the operations started to 354,688 tons, and the amount of back filling to 25,475 cubic yards.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Brandon Hills, Man.
Tenders on the construction of a road through the Brandon Hills will be received until July 23rd, by D. W. Shaw, Bank of Hamilton Chambers, Brandon. Plans and specifications at the Municipal Chambers, Bank of Hamilton Chambers, Brandon.

Chambly Basin, Que.
The Secretary to the Municipal Council will receive tenders until 7 p.m., July 26th, for the supply and installation of 34,000 feet of sewer pipe, 800 feet of steel pipe, and two electric turbine pumps, with capacities of 600,000 and 400,000 gallons per day respectively.

Guelph Township, Ont.
The Township Council have passed a by-law providing for the laying of a concrete sidewalk on College Heights. Engineer, E. J. Holland.

Hamilton, Ont.
The City Engineer has recommended that asphalt paving be laid on Spruceside Avenue and Kent Street. City Clerk, S. H. Kent.

Hull, Que.
The City Council are now receiving tenders on the supply of 3,475 feet of 12-inch cast iron pipe, 4,710 feet of 10-inch, 9,425 feet of 8-inch, 8,550 feet of 6-inch, and 64,450 pounds of specials of different sizes. Engineer, J. P. A. Laforest.

Hullet Township, Ont.
Tenders on the deepening of the McCall Extension Drain will be received until 2 p.m., July 29th, by the Township Council. Clerk, James Campbell, Londesboro.

Maisonneuve, Que.
The paving of a number of streets has been decided on by the City Council. Engineer, M. Dufresne.

Millardville, B.C.
The Municipal Council have adopted a scheme for waterworks installation recommended by the Engineer. Estimated cost, $8,175.

Port Colborne, Ont.
The Town Clerk, D. Alair, will receive tenders until 6 p.m., July 24th, for the construction of about 1½ miles of macadam roadway.

Sandwich, Ont.
A by-law for the construction of a quantity of silex sidewalk at an approximate cost of $3,000 will be submitted to the ratepayers on August 7th. Town Clerk, E. R. North.

Thorold, Ont.
Cement sidewalks are being laid on West Mill, Metcalfe, Queen and Albert Streets by day labor.

The Town Council have passed a by-law for the construction of sewers on various streets. Tenders for the work will be called later. Clerk, D. J. Munro.

Toronto, Ont.
The Board of Control will receive tenders until August 3rd for the construction of sewers on Jones and Boultbee Avenues, Queen Street and Kingston Road.

CONTRACTS AWARDED

East Kidonan, Man.
The following contracts have been let by the Municipality:—laying watermains, Nagle & Dunlea, 402 College Avenue, at $9,605; supply of pipes and fittings, Canada Iron Corporation, 147 Bannatyne Avenue, $18,350; valves, T. McAvity & Sons, Ltd., 147 Bannatyne Avenue, $1,287; meters, National Meter Company, 229 Spence Street, $706.

Fairbank, Ont.
The Trustees of School Section No. 15, York, have let the contract for the construction of concrete walks at the Vaughan Road School to A. J. Penberthy, 292 Booth Avenue.

Lachine, Que.
The following contracts have been let by the City Council:—supply of cast iron water pipe, Dominion Bridge Company; sewer pipe, valves and hydrants, Alexander Clement; sand, A. Leclair & Son; stone for macadam and cement, Lapailleur & Frere, 406 St. Joseph Street.

Kent County, Ont.
The contract for the construction of a watermain to the House of Refuge has been awarded by the County Council to James Doyle, 92 Cross Street, Chatham, at $3,500.

Montreal, Que.
The general contract for the erection of a pump building for the Board of Commissioners has been let to Arsenalt & Plamondon, 70 St. James Street.

The following contracts for the supply of paving blocks have been awarded by the City Council:—W. McValley Company, Ltd., 120,000 at $49.25 per M.; Elder Ebano Company, Ltd., 11 Place D'Armes, 460,000 at $48.95 per M.; Webster & Sons, Ltd., 31 Wellington Street, 460,000, at $44.75 per M.; Benoit & Lafonde Granite Company, 30 St. James Street, 410,000 at $1.65 per square yard; Sicilv Asphalt & Paving Company, 60 St. Viateur Street E., 410,000 at $1.65 per square yard.

Oshawa, Ont.
A contract for the construction of about 8,000 square yards of concrete pavement for the Town Council has been let to Drew & Flintoff.

Ottawa, Ont.
The City Council have let a contract for laying asphalt pavement to the Ottawa Construction Company, Central Chambers.

Outremont, Que.
The Municipal Council have let a contract for the supply of 280,000 vitrified shale wire-cut paving blocks to A. Bremner, 100 Bleury Street, Montreal, at $39 per thousand.

Ritchot, Man.
The Municipality have let contracts for road grading to D. Carriere, P. Lavallee, A. Delorne, and D. Lagasse, and for the construction of culverts to K. Schioler & P. LaCour, 1114 Garfield St., Winnipeg.

St. Catharines, Ont.
The City Council have awarded the following contracts:—Warren Bituminous Paving Company, 103 Bay Street, Toronto, bitulithic pavements at $2.29 per square yard, and concrete curbs and gutter at 60c. per lineal foot; Newman Bros., 74 St. Paul Street, brick block pavement at $2.35 per square yard, and concrete sidewalk and curb; Creosote Block Paving Company, Royal Bank Building, Toronto, wood block pavement, at $3.05 per square yard.

Winnipeg, Man.
The contract for laying a sewer on Stafford Street has been awarded by the Board of Control to the Dominion Contracting Company, 632 Aberdeen Avenue.

The Board of Control have let the contract for the supply of lead pipe to James Robertson Company, 175 Pacific Avenue, at $9.50 per 100 pounds.

Railroads, Bridges and Wharves

Hastings County, Ont.
Work is about to start on the construction of six bridges by day labor under the supervision of Lucius E. Allen, C. E., Belleville. Material will be purchased by J. A. Gunter, P. O. Gunter, and Mr. Allen.

London, Ont.
The breakwater is being built by day labor, under supervision of City Engineer H. A. Brazier. Approximate cost, $25,000.

Proton Township, Ont.
Tenders on the construction of a concrete arch bridge will be received until noon, July 26th, by W. J. Bellamy, Flesherton, Ont. Plans and specifications with the Engineer, R. McDowall, Owen Sound, and with Mr. Bellamy.

St. Rose, Que.
The Municipal Secretary, Henry Chapleau, will receive tenders until 7 p.m., July 27th, for the construction of a concrete pillar at the Lachapelle Bridge. Plans and specifications with the Secretary.

CONTRACTS AWARDED

Halifax, N.S.
The contract for the construction of a wharf for the Furness, Withy Com-

pany, Water Street, has been awarded to the Nova Scotia Construction Company, 159 Upper Water Street. Reinforced concrete construction. Estimated cost, $200,000.

Hanover, Ont.
A contract for building concrete abutments for a bridge has been let by Road Commissioner D. Willoughby, R. R. No. 2, Elmwood, to Hugh Watt, Chesley.

La Loutre, Que.
The contract for the construction of a storage dam on the St. Maurice River for the Quebec Streams Commission has been let to Joseph Gosselin, Levis. Approximate cost, $1,300,000.

Lunenburg County, N.S.
The contract for the construction of culverts for the Department of Public Works, Halifax, has been awarded to Arthur Hood, Shelburne County, at $5,300.

Peel County, Ont.
The County Council have awarded a contract for the erection of two concrete bridges to Charles Mattaini, Tower Street, Fergus, and for three bridges to H. E. Croft, 113 Cambridge Street, Guelph.

St. Francois Xavier, Man.
The contract for the erection of a reinforced concrete bridge for the Municipality has been let to Buchanan & Hinds, Builders' Exchange, Winnipeg, at $3,100.

York County, Ont.
The County Council have awarded the contract for flooring the Summerville Bridge to the Creosoted Wood Block Company, 2 King Street E., Toronto.

Public Buildings, Churches and Schools

Aroostock Junction, N.B.
Plans of a school have been submitted to W. S. Carter, Chief Superintendent of Education, Fredericton, N.B. Brick construction. Estimated cost, $7,000.

Balcarres, Sask.
Work by day labor is about to start on the erection of a church for the Roman Catholic Congregation. Particulars from Rt. Rev. O. E. Mathieu, D. D., 2107 McIntyre Street, Regina. Estimated cost, $3,000.

Barachois De Malbaie, Que.
Tenders on carpentry, painting and the installation of a heating system at the Church will be received until July 24th by J. C. Plourde. Architect, Thomas Raymond, 43 Charon Street, Quebec.

Forget, Sask.
The Trustees of School District No. 1 have been authorized to borrow $3,700 for the erection and equipment of a school. Treasurer, C. M. Force, Forget.

Indian Head, Sask.
Tenders on the erection of a Forestry Office will be received until 4 p.m., August 9th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at offices of H. E. Matthews, Superintending Architect of Dominion Public Buildings, Winnipeg, W. T. Mollard, Clerk of Works, Regina, the Superintendent, Forestry Station, Indian Head, and at the Department, Ottawa.

Kentville, N.S.
The plans for a sanatorium, prepared by W. M. Brown, Merchants Bank Building, Halifax, have been found too costly, and new plans will be drawn. Estimated cost, $4,000.

Kingsville, Ont.
Tenders will be called shortly for remodelling the Methodist Church Sunday School. Work to consist of erection of two galleries, other interior alterations and installation of a ventilating system. Architect, T. Jenner, Amherstburg, R. R. No. 1. Approximate cost, $3,500.

Malbaie, Que.
The fixtures and furnishings for the college which has been erected for the School Commissioners of Murray Bay will be purchased by the President, J. E. Maltais, and the Secretary, J. McNicholl.

Orillia, Ont.
Tenders on alterations to heating and ventilating systems are now being received by T. W. Robins, Secretary to the Collegiate Institute Board, Orillia.

Paisley, Ont.
Robert Colwell, R. R. No. 2, Paisley P. O., will receive tenders until July 30th for the supply and installation of a hot air furnace and seating at the School in Section No. 10, Bruce and Greenock.

Perth, N. B.
Plans of a four-roomed frame school have been submitted to W. S. Carter, Chief Superintendent of Education, Fredericton, N. B. Estimated cost, $7,000.

Repentigny, Que.
The erection of a school is contemplated by the School Commissioners. Secretary, J. U. Perrault, Repentigny.

St. Constant, Que.
A school is being erected here at an approximate cost of $5,000. Secretary to the School Commissioners, Lorenzo Letrourneau.

St. Lin, Que.
The School Commissioners are considering the construction of a school. Secretary, J. Archambault.

Toronto, Ont.
Tenders will be received until 2 p.m., July 26th, by the Secretary, W. C. Wilkinson, Board of Education, City Hall, for the erection of additions to the King Edward and Manning Avenue Schools, and for iron fences and stairs, concrete floors, electric work, local telephones and midsummer repairs at various schools. Plans and specifications at office of Superintendent of Buildings, City Hall.

Waterford, Ont.
The School Board have had plans prepared for a High School, and tenders will be called shortly. Approximate cost, $4,400. Chairman, L. L. Sovereign.

Windsor, Ont.
Tenders for plumbing and carpentry work at Mercer and Tuscarora Street Schools are being received by G. A. Courtney, Secretary to the Board of Education.

CONTRACTS AWARDED

Clinton, Ont.
Work is about to commence on the erection of an addition to the Collegiate Institute. The masonry, cement, brickwork and plastering contracts have been let to Prior & Sweet, the carpentry and woodwork contracts to Thomas McKenzie, King Street, the contract for plumbing, heating, roofing and interior fittings to Bryan & Sutter, and for painting to Thomas Crealis.

Gifford, Que.
In connection with the presbytery in course of erection for the parish of St. Ignace de Loyola, the carpentry and plastering contracts have been let to the general contractor, G. Parent, Gifford, the roofing, heating, plumbing and electrical contracts to J. Gagnon, Beauport, and the contract for painting to Charles Roussel, 60 Ste. Ambroise Street, Ottawa.

Halifax, N.S.
Work has been commenced on the erection of a laundry at the Convent of the Sacred Heart, Spring Garden Road, by the general contractors, S. M. Brookfield, Limited, 58 Granville Street. The masonry, carpentry, steel, plastering and painting contracts have been let to the general contractors, and the contracts for heating, plumbing and electrical work to Farquhar Bros., Ltd., Barrington Street. Approximate cost of work, $6,000.

Kingsville, Ont.
The general contract for the erection of an addition to the school has been let by the Board of Education to H. Holt, at $3,375, and for heating work to Scratch & McDonald.

Lakeside, Ont.
Work has been started on the erection of a church for the Methodist Congregation by William Crellin, Kintore. Estimated cost, $7,000. Pews, windows, furnaces, pulpit, etc., will be purchased by Robert Rawlings.

London, Ont.
In connection with alterations to the Baptist Church on Talbot Street, the contract for painting and decorating has been let to W. T. Mossops & Company, 644 Lorne Avenue, and for seating to the Valley City Seating Company, Dundas.

Montreal, Que.
The contract for steel work in connection with the erection of a fire escape at the Sherbrooke Street School has been let to the Montreal Architectural Iron Works Company, 157 Prince Street.

Quebec, Que.
In connection with the chapel being built on St. Foy Road for the Sisters of St. Joseph de St. Valier, the plastering, painting, plumbing, heating and electrical work will be done by the general contractor, E. Rochette, 71 Des Stigmates Street.

Scarboro Junction, Ont.
Work will start shortly on the erection of a school in Section No. 10. The masonry contract has been let to H. Webster, Bannington Avenue, and the contract for carpentry to H. Walton, Coleman Avenue. Estimated cost, $8,000.

Toronto, Ont.
Work has been commenced on the erection of an addition to St. John's Church, Kingston Road and Woodbine

Avenue. The following contracts have been let:—masonry, A. Duckworth, 155 Cedervale Avenue; carpentry, W. Williamson, 137 Woodbine Avenue; plumbing, F. Toseland, 304 Kingston Road; lead glass, Luxfer Prism Company, 100 King Street W.; painting and decorating, W. M. Weekes, 37 Wilton Avenue. Estimated cost, $10,000.

The contract for the construction of foundations for the school on Baby Point Road has been let by the Trustees of School Section No. 32, York, to R. Smith, Jane Street.

Valbryant, Que.
Work is progressing on the erection of a Presbytery estimated to cost $15,000. The masonry, carpentry and steel contracts have been let to the general contractor, Joseph Coulture, 19 St. Joseph Street, St. Levis.

Business Buildings and Industrial Plants

Hamilton, Ont.
Tenders for remodelling the Y. M. C. A. Building at 81 St. James Street S. are being received by the architects, Mills & Hutton, Bank of Hamilton Bldg.

Hull, Que.
Work by day labor has been started on the erection of a garage for N. Beaudin, Albion Hotel. Approximate cost, $3,500.

Lake Rush, Que.
The erection of a sawmill is being considered by P. H. Renaud, Agnes Street, Megantic.

Levis, Que.
Plans are being prepared for a drug store and residence to be erected at Commercial and Fraser Streets for Joseph Leblond. Architect, L. Auger, 36 St. John Street. Approximate cost, $8,000.

Montreal, Que.
Mrs. L. Glass, 1467 Garnier Street, is having a shed built at a cost of approximately $7,000.

Tenders on all trades excepting carpentry required in the construction of a coal storage building are being received by Mrs. L. Glass, 1467 Garnier Street. Estimated cost, $7,000.

New Westminster, B. C.
Work on the erection of an elevator and warehouse on Front Street for the Brackman Ker Milling Company will be done under the supervision of F. T. Sherbourne, 2046 Beach Street, Vancouver.

Okanagan Landing, B.C.
The station, roundhouse and turntable which the Canadian Pacific Railway proposed to erect here will not be built.

Ottawa, Ont.
T. Lawson & Son, Limited, have had plans drawn for an addition to their shop and offices on Wellington Street. Brick construction, felt and gravel roofing, concrete foundation. Estimated cost, $4,500.

Quebec, Que.
The contract for heating and plumbing at the Union Station in course of erection at St. Poul and Henderson Streets has been let to Vandry & Matte, 169 St. John Street.

Victor Giguerre, 10 Gosford Street, is erecting a store and residence on Fifth Street, Limilou, estimated to cost $10,000. Brick construction, concrete foundation.

Richards, N.B.
H. Bouday, M.P., Rimouski, is about to rebuild his sawmill, which was recently destroyed by fire. Work by day labor.

Sherbrooke, Que.
The City Council have decided to proceed with the erection of a gas plant at once. Estimated cost, $70,000. Engineer, Thomas Tremblay.

St. Jerome, Que.
The erection of a foundry is being considered by Alfred A. Viau, 7 St. Joseph Street.

CONTRACTS AWARDED

Brantford, Ont.
Work on the erection of a car-barn and sub-station for the Lake Erie & Northern Railway Company, 28 West Mill Street, will be started at once by the general contractors, H. Secord & Sons, Limited, 133 Nelson Street. Brick construction, concrete and brick foundation, felt and gravel roofing. Estimated cost, $3,500.

In connection with the factory erected on Grey Street for the Brantford Computing Scale Company, Limited, the contract for plumbing has been let to J. W. McHutchison, 101 Murray Street.

Goudreau, Ont.
The contract for the erection of a power house, etc., for the Madoc Mining Company, has been let to the Deakin Construction Company, Limited, 41 Mayor Street, Montreal, on a percentage basis. Approximate cost, $75,000.

Halifax, N.S.
The general contract for the erection of a machine shop for T. Hogan & Company, 123 Water Street, will probably be let to S. M. Brockfield, 58 Granville Street.

Margaree, N.S.
The contract for the construction of a creamery for the Department of Public Works, Halifax, has been let to T. Fraser, Whycocomagh, at $3,000, and the contract for pipe laying to J. C. White, East Margaree.

Montreal, Que.
W. Dufault, 784 Ontario Street E., has let the general contract for the erection of a store and residence to Lacroix & Vezeau, 491 Demontigny Street E. Approximate cost, $3,500.

Work is progressing on the erection of a coal storage building at 1467 Garnier Street for Mrs. L. Glass. The general and carpentry contracts have been let to Nathan Aloff, 1463 Garnier Street. Approximate cost, $7,000.

Ottawa, Ont.
The general contract for the erection of a store and residence for J. Kleegan has been awarded to F. A. Gieck, Cummings Bridge P. O Brick veneer construction, brick foundation, felt and gravel roofing Approximate cost, $3,500.

The contract for alterations to a store on Sparks Street for the Bank of Ottawa, 116 Wellington Street, has been let to G. Douglas, 382 Waverley Street.

The general contract for alterations to a store for C. A. Douglas, 95 Sparks Street, has been let to Shuttleworth & Black, 21 Euclid Avenue, the contract for copper work to McFarlane & Douglas, Slater Street, and for glazing to W. J. Carson, 293 Laurier Avenue W. Approximate cost, $3,500.

Quebec, Que.
In connection with the store and residence in course of erection for Joseph Cote, 180 St. Paul Street, the contract for plastering has been awarded to V. Parent, 449 St. Francois Street. Painting not let.

Riviere Du Loup, Que.
In connection with the store in course of erection for A. E. Thivierge, the contract for heating and pulmbing has been let to Paquet & Company, and for electrical work to J. A. Thibault. Roofing will be done by the general contractor, J. Charest.

In connection with the store and warehouse in course of erection for T. Langlis, Lafontaine Street, the contract for brickwork has been let to N. Dupont, the woodwork and roofing contract to L. Cote & Lachance & Fils, and the heating contract to Wilfred Beruhe. Estimated cost, $25,000.

St. John, N.B.
The general and carpentry contracts for the erection of a business block for the James Kennedy Estate, 20 King Street, has been awarded to Stanley Williams, Prince William Street, at $8,000, and the masonry contract to R. A. Corbett, Douglas Avenue.

Toronto, Ont.
Work has been started on interior alterations to the store and warehouse of Gourlay, Winter & Leeming, 188 Yonge Street, by the Sutherland Construction Company, 315 Ryrie Building. Estimated cost, $6,500.

Winnipeg, Man.
The following contracts have been awarded in connection with the stores being built for J. Scarf, Kildonan:—brick work, Fletcher & Bold, 178 Rondolph Street; carpentry, Stewart & Green, Perth Avenue; roofing and heating, O-Rib-O Manufacturing Company, Limited, 233 Stradbrooke Ave.; plumbing, W. Wilson, 810 Alverstone Street; electrical work, D. Woodhead, 549 William Avenue.

In connection with the warehouse being built at Chambers and Henry Streets for the Cream of Wheat Company, Minneapolis, Minn., the masonry, carpentry, plastering and painting contracts have been awarded to the general contractor, T. Sharpe, Kennedy and Qu'Appelle Streets, the electrical contract to Marshall Wells Company, Limited, Market Street, and the heating and plumbing contract to Cotter Bros., Ltd., Fort St.

The general contract for the erection of an addition to the King Street Substation has been let by the Board of Control to J. Gunn & Sons, Bank of Nova Scotia Building, at $22,075.

Residences

Bloomsburg, Ont.
Lewis Culver is building a frame residence, estimated to cost $3,000.

Grondines, Que.
Work has been commenced by day labor on the erection of a brick and frame residence for Charles Laganiere. Estimated cost, $8,000.

Halifax, N.S.
Plans of a residence are being drawn for J. M. Davidson, Oxford Street, by W. M. Brown, Merchants Bank Bldg.

Hamilton, Ont.
The erection of a garage and conservatory is contemplated by J. H. Harming, Maple and Blake Streets. Architect, F. W. Warren, Bank of Hamilton Building. Estimated cost, $3,000.

C. G. Hudson, 10 Edinburgh Street, is about to erect a residence; estimated to cost $3,500. Brick construction, stone foundation, shingle roofing.

Montreal, Que.
J. D. Lapointe, 74 Second Avenue, Viauville, is building a residence on Notre Dame Street E., estimated to cost $5,000.

The erection of two residences on Letellier Street has been commenced by E. Picard, 2075 Gouin Boulevard. Approximate cost, $4,000.

F. R. Lanthier, care of the Kingsbury Footwear Company, 679 LaSalle Avenue, contemplates alterations to his residence at 373 Sherbrooke Street E., estimated to cost $5,000.

Joseph Cote, 85 Richmond Street, is building six flats on Mullins Street, at an estimated cost of $4,500. Brick construction, felt and gravel roofing.

Ottawa, Ont.
A. Levinson, 227 Somerset Street E., has prepared plans of a residence to be built on Murray Street at an approximate cost of $6,500. Brick construction, stone foundation, shingle roofing.

W. J. Girvan, 130 Grighton Street, has prepared plans for a residence estimated to cost $4,000. Brick veneer construction, stone foundation, shingle roofing.

The Oakland Land Company are considering the erection of a residence on Bellwood Street at an estimated cost of $5,000. Brick veneer and stucco construction, stone foundation, shingle roofing. Manager, W. J. Spratt, Sunnyside Avenue.

Outremont, Que.
Tenders on plastering, painting, heating, plumbing and electrical work required in the erection of a residence for J. H. Lemieux, 116 Laval Avenue, are being received. Architect, J. Mercier, 22 Craig Street E.

Port Dover, Ont.
A residence, estimated to cost $3,000, is being built by Percy Ryerse, First Avenue. Frame construction, shingle roofing.

Quebec, Que.
The roofing, plumbing and electrical work in connection with the residence being built on Aberdeen Street by E. C. Brochu, 147 St. Cyrille Street, will be done by day labor.

G. Cantin has commenced the erection of a residence on Lee Street, estimated to cost $5,000. Masonry and carpentry will be done by day labor. Contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

Thorold, Ont.
Work by day labor has been started on the erection of dwellings for T. J. Foley. Frame construction. Estimated cost, $6,000.

Toronto, Ont.
Davis & Moore, 176 St. Clarens Avenue, have commenced the erection of a pair of residences at 13-15 Brock Crescent. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Plans of a residence to be built at 66 Alexandra Boulevard are being prepared by D. McIntosh, 1119 Yonge St. Estimated cost, $5,000.

The erection of a residence at 46 Alexandra Boulevard has been commenced by J. Percy, 50 Heath Street E. Emaller trades will be let. Approximate cost, $5,000.

H. Cramp, 28 Waylane Avenue, is building a pair of residences on Bingham Street, estimated to cost $4,000. Smaller trades will be let. Brick construction, concrete and brick foundation, shingle roofing.

Work is progressing on the erection of four residences on Beech Avenue, estimated to cost $12,000. Smaller trades will be let by the owner, S. Jackson, 323 Beech Avenue. Brick construction, shingle roofing.

A. Woolrich, 1 Brock Crescent, is razing old buildings on Awde Avenue preparatory to the erection of a pair of residences. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,800. Smaller trades will be sub-let.

CONTRACTS AWARDED

Beaupont, Que.
In connection with the residence in course of erection for A. Marcil, the masonry contract has been let to A. Latulippe, 118 Bagot Street, and the roofing, heating, plumbing and electric contracts to V. Gauvin, Limoilou. Painting not let.

Belleville, Ont.
The contract for the erection of stores and apartments for the Lister Estate has been let to Perry Denike, 303 Ann St. Approximate cost, $3,000.

Bridgeburg, Ont.
J. C. Purvis has let the carpentry and roofing contracts for the residence in course of erection on Niagara Street to B. Zimmerman.

C. E. Hansel, 204 Ontario Street, St. Catharines, has let the general, carpentry and roofing contracts for the erection of a residence to Oscar C. Teal. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Guelph, Ont.
The following contracts have been let in connection with the three residences in course of erection on Sydenham Street for H. G. Cockburn, Park Avenue:—plastering, J. J. Mahoney, Kent Street; heating, McCormick & Robinson, Market Square; plumbing, Stevenson & Malcolm, Masinoc Building; electrical work, G. E. B. Gringer, Wilson Street.

Halifax, N.S.
In connection with the residences now being erected on Bloomingdale Avenue for R. P. Bell, 3 Prince Street, the contract for plastering and brickwork has been awarded to A. Hutchinson, Dartmouth, N.S., the heating and plumbing contract to Hayman & McKenzie, Water Street, and the electrical contract to J. Starr & Son, Limited, Harbour Street.

Hamilton, Ont.
In connection with the residence in course of erection at Connaught Park for E. W. Vivian, 408 Barton Street E., the heating and plumbing contracts have been let to J. E. Gibson, 676 King Street E. Plastering, painting and electrical work not yet awarded.

London, Ont.
The contract for the erection of a residence for Alexander Campbell, 731 Waterloo Street, has been let to Evans Bros., 905 Queens Avenue. Red pressed brick construction. Approximate cost, $4,000.

The following contracts for the erection of an apartment on William Street for W. Thomas, 531 Dundas Street, have been awarded:—masonry, H. Hayman, 491 Ontario Street; carpentry, R. G. Wilson; plumbing and heating, L. J. Odell, 634 Princess Avenue; plastering, Arthur Dowell, 563 Adelaide Street; slating, J. Whittaker, King Street; electric work, Peoples Electric Company.

The general contract for the erection of a residence at 366 Maitland Street for Mrs. Smibert, Burwell Street, has been let to J. A. Stanley, 1063 Richmond St. Estimated cost, $4,000.

Work has been commenced on the erection of apartments at 512 Williams Street for W. D. Thomas, 531 Dundas Street, by H. Hayman, 491 Ontario St., and R. G. Wilson & Son, 5 St. George Street. Smaller trades will be sub-let. Approximate cost, $6,000.

Maisonneuve, Que.
In connection with the flats being erected by Carriere & Frere Company, Ltd., 31 Laurier Avenue, Montreal, the plastering contract has been let to Charbonneau & Dupre, 1651 Park Avenue, the contract for painting to W .Bourdon, 47 Desjardins Avenue, and for heating and plumbing to J. Vaillancourt, 43 Laurier Avenue W., Montreal.

H. Bernier, 758 Adam Street, has let the contract for heating and plumbing in connection with the residence in course of erection to George Lamothe, 174b Valois Street, Montreal. Report previously published incorrect.

Montreal, Que.
P. Morin, 1158 Bernard Street, has commenced the construction of three flats on the Esplanade, estimated to cost $5,000.

A residence is in course of erection on Notre Dame Street E., for J. D. Lapointe, 74c. Second Avenue. General contractor, Louis Beaudry, Pointe-aux-Tremble. Approximate cost, $5,000.

North Bay, Ont.
The contract for heating and plumbing at the residence in course of erection for W. Aubrey has been awarded to the Cochrane Hardware Limited, 18 Main Street West.

Oshawa, Ont.

A. Black has let the masonry, carpentry and tinsmithing contracts for the erection of a residence to W. J. Holland, Simcoe and Colborne Streets.

Ottawa, Ont.

Bower Bros., 133 Hopewell Street, have let the contract for heating and plumbing in connection with the residence which they are building on Aylmer Street to T. Watters, 288 Booth Street, and the electrical contract to the Dominion Electric Company, 417 Sparks Street. Plastering and painting not yet awarded.

The contract for plumbing and heating in connection with the residence in course of erection for W. F. B. Martin, 145 Third Avenue, has been let to M. M. O'Connell, Limited, 212 Gloucester St.

Work has been started on the erection of apartments on Bethany Street for J. Quinn. The general contract has been let to L. McDonald, 80 Fairmont Street. Brick construction, felt and gravel roofing. Approximate cost, $6,000.

In connection with the tenements being built on York Street by N. Poirier & Son, 193 Cathcart Street, the contract for heating and plumbing has been let to A. Gauthier & Company, Dalhousie Street, and for electrical work to A. C. McDonald, 48 College Street.

Quebec, Que.

Lavoie & Frere, 56 Jeanne d'Arc St., have let the roofing; heating, plumbing and electrical contracts in connection with the residence in course of erection on Aberdeen Street to P. Paradis, 236 d'Aguillon Street. Painting not let.

The contract for masonry in connection with the residence being built on Moncton Street for P. Trudel, 43 d'Aguillon Street, has been awarded to Jinchereau & Lamonde, Grand Alle, the roofing contract to E. Falardeau, 308 Queen St., and the heating, plumbing and electrical contracts to J. B. Cote, 49 Grant Street.

E. A. Tremblay, 69 St. Nazaire Street, has let the contract for roofing at the residence in course of erection on Bourlamarque Street to O. Barbeau, 154 Franklin Street, and for heating, plumbing and electrical work to J. Brown, 11 Arsenal Street. Painting not let.

In connection with the residence being built on Bourlamarque Street by J. Nadeau, 139 Notre Dame Des Anges Street, the contract for masonry and plastering has been awarded to J. B. Verret & Fils, Limoilou, the roofing contract to O. Barbeau, 154 Franklin Street, and the heating, plumbing and electric contracts to J. Lafrance, 21 Plessis St. Carpentry and painting by owner.

In connection with the residence in course of erection for E. Dube, 163 St. Olivier Street, the masonry contract has been let to V. Parent, 449 St. Francois Street, and the carpentry contract to E. Breton, 75 Latournelle Street. Other trades not let. Approximate cost, $6,000.

Lavoie & Frere, 52 Jean d'Arc Street, are building a residence for N. Maison, 23 d'Artigny Street, estimated to cost $6,000. The roofing, heating, plumbing and electrical contracts have been let to P. Paradis, 236 d'Aguillon Street. Painting contract not yet awarded.

Toronto, Ont.

Work has been started on the erection of a rectory on Annette Street for the congregation of St. Cecilia's Roman Catholic Church. The carpentry contract has been let to Madden Bros., 552 Adelaide Street West.

T. A. Manning, 79 St. Clair Avenue E., has let the plastering contract in connection with the residence being built at 101 Walmsley Blvd. to Petrie & Son, 353½ Dupont Street, the contract for painting to A. K. Ottaway, 108 Alcina Ave., and for heating to James & Son, 550 St. Clair Avenue W.

Sparrow & Holden, 167 Ronan Avenue, have let the plastering contract in connection with the erection of a residence to F. Antill, 379 Mount Pleasant Road, the contract for heating and plumbing to G. Moore, 165 Ronan Avenue, and for electrical work to F. A. Turpin, 116 Brunswick Avenue. Brick construction, shingle roofing. Approximate cost, $3,000.

John Tait, 58 Manor Road, is erecting two pairs of residences at 1-7 Park Ave., for C. F. Wagner, 66 Gloucester Street. Smaller trades will be sub-let. Estimated cost, $12,000. Brick construction, shingle, felt and gravel roofing.

Westmount, Que.

The masonry, carpentry and plastering contracts for the erection of a residence for Mrs. L. C. Fee, have been let to T. S. Hudson & Company, Board of Trade Building, Montreal.

Power Plants, Electricity and Telephones

Latuque, Que.

The residence of Oscar Fontaine has been destroyed by fire.

Maisonneuve, Que.

The City Council have decided to purchase a quantity of street lamps and posts. Engineer, M. Dufresne.

Otterville, Ont.

The installation of a hydro-electric system is being considered by the Town Council. Estimates of the cost have been furnished by the Provincial Commission.

Port Rowan, Ont.

The Town Council are obtaining estimates of the cost of installing an electric light plant. Clerk, W. A. Mabee.

Saskatchewan Province

The following Rural Telephone Companies have been authorized to borrow money for the construction of their systems:—Colfax, $8,300, Secretary, A. R. Thomas, Colfax; Gartmore-Zorra, $6,000, H. E. Mapleton, Shillingthorpe; Goodwater, $3,000, D. Dalgleish, Goodwater; Great Deer, $2,500, D. R. Dyck, Borden; Kilmory, $3,800, A. H. Burke, Watrous; Kronau, $8,000, R. R. McElmon, Kronau; New Deloraine, $5,500, A. J. Robertson, Davidson; North Churchbridge, $25,000, A. T. Penwarden; Silverwood, $3,600, Roy Scott, Wapella; South Radisson, $4,000, R. McNaught, Radisson; South Tyvan, $2,700, J. Simpson, Tyvan; Talmage, $5,000, W. T. Crayford, Talmage; Third Meridian, $2,500, E. N. Keeney, Davidson; Thorson, $1,700, M. B. Curry, Macoun; West Graytown, $13,000, B. Brouillet, Graytown.

Winnipeg, Man.

Tenders will be received until July 26th by the Chairman of the Board of Control for two 50-light, high efficiency, incandescent street lighting equipments, complete with lamps. Plans and specifications at office of the Engineer, J. G. Glassco, 54 King Street.

Fires

Brome, Que.

The Dominion Government Creamery has been totally destroyed by fire. Minister of Agriculture, Hon. Martin Burrell.

Leeds Station, Que.

A store, residence, sawmill and cheese factory, belonging to Theophile Beaudoin, have been destroyed by fire. Loss, $12,000.

Mount Forest, Ont.

Fire has caused the following losses: V. E. Lewis, tailor shop, store and residence, $4,500, covered by insurance; H. W. Palmateer, store and express office, $3,000, insurance, $1,500. Mr. Palmateer will possibly rebuild.

Quebec, Que.

A residence belinging to Dion & Freres, 84-86 Victoria Street, has been destroyed by fire. Estimated loss, $5,000.

Fire has destroyed the residence of Mrs. J. Genest, 88 Victoria Street. Loss, $5,000.

Miscellaneous

Chatham, Ont.

The Town Council have passed a by-law for the purchase of motor fire apparatus and truck, at an estimated cost of $13,000. Tenders will be called at once if by-law carries at the polls. Clerk, W. G. Merritt.

Outremont, Que.

The Municipal Council are in the market for machines for penetrating asphalt work. Secretary, E. T. Sampson.

Toronto, Ont.

The Rock & Power Machinery Company, 58 Church Street, are in the market for one ten or fifteen ton locomotive crane, 8 wheel, 38 to 40 ft. boom, equipped with Clam Shell bucket and Ontario boiler.

CONTRACTS AWARDED

Hamilton, Ont.

The City Council have let a contract for the supply of three Chapman rectangular sluice gates to the Turbine Equipment Company, Ltd., C. P. R. Building, Toronto.

Montreal, Que.

J. A. Brosseau, 53 Boyer Street, has awarded a contract for the installation of a baker's oven to Dufort & Mignolet, 240a St. Antoine Street. Fire brick construction. Approximate cost, $5,000.

Transcona, Man.

The Turbine Equipment Company Ltd., C. P. R. Building, Toronto, have been awarded a contract for the supply of two De Laval 8-inch vertical single stage sewage pumps, with a combined capacity of three million gallons per day.

Tenders and For Sale Department

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to **Thursday, 29th July, at 2 p.m.**, for the deepening, widening and straightening of the Drain or Creek known as the "McCall Extension Drain," from a point in the eastern limit of the N ½ of Lot 9, Con. 14 to the outlet at Lot 16, Con. 10, Hullett. An accepted cheque of 5 per cent. will be required to be furnished by the successful tenderer.

The lowest of any tender not necessarily accepted.

JAMES CAMPBELL,
Township Clerk.
29

Tenders for Sewers and Cement Sidewalks

Municipality of Village du Bassin de Chambly

Separate sealed tenders for the construction of sewers and cement sidewalks will be received until **Monday, 7 p.m., July 26th, 1915**, and must be addressed to the Secretary-Treasurer of the Municipality of the Village du Bassin de Chambly, and deposited at his office, said sewers and sidewalks to be constructed in the streets of said Village.

The plans and estimates of these works may be examined at the office of the municipal engineer, M. J. Avila Gravel, 17 Cote Place d'Armes, Montreal.

Any person tendering must deposit an accepted cheque from a chartered Canadian bank, payable to the Municipality of Village du Bassin de Chambly, and amounting to 10 per cent. of the amount of said tender.

The Municipal Council shall be perfectly free to accept or reject any of the tenders. By order,

J. AVILA GRAVEL,
Civil Engineer.
29

Town of Drumheller, Alberta

Waterworks

Sealed tenders, addressed to the undersigned, will be received up till **20 o'clock on Monday, 16th August, 1915**, for the following contracts:—

1. Supply of about one mile of 6-inch and 4-inch steel or cast iron pipe.
2. Supply of Valves and Hydrants.
3. Supply of one H. R. T. Boiler and Stack.
4. Supply of Duplex Pump.
5. Supply of materials for 30,000-gallon wood tank and housing.
6. All labor and certain materials for laying water mains, sinking an open well, constructing pumping station, and erecting wood tank and housing.

Tenders must be accompanied by an accepted cheque for ten per cent. of the amount of the tender.

Plans and specifications and other information may be obtained at the offices of the Consulting Engineers at Winnipeg and Calgary. A deposit of $25.00 will be required on Contract No. 6, which will be returned to bona fide tenders on return of the plans.

The Corporation do not bind themselves to accept the lowest or any tender.

O. McKEE,
Secretary-Treasurer,
Drumheller, Alta.
THE JOHN GALT ENGINEERING CO., LTD.,
Consulting Engineers,
Winnipeg, July, 1915 29

WANTED

For cash, one 8-wheel locomotive crane, about 10 ton, with 38-ft. or 40-ft. boom, and equipped with Clam Shell Bucket. Boiler must pass Ontario specifications.

ROCK & POWER MACHINERY COMPANY,
29 58 Church Street, Toronto.

Tenders for Foundry

Sealed tenders will be received by the undersigned up to **July 29th** for the erection and completion of a Foundry Building at Brighton. All tenders to be marked "Tender for Foundry." Plans and specifications may be seen at the office of the secretary.

Lowest or any tender not necessarily accepted.

GEO. DREWRY,
Secretary of The D. J. Barker Foundry Company, Limited,
29-30 Brighton, Ont.

County of Brant

Sealed tenders, clearly endorsed on the outside, "Tenders for Puttown Bridge" will be received by the Counties of Oxford and Brant up to **12 noon, on Wednesday, 28th July, 1915**, addressed to the County Clerk, County Building, Brantford.

For 150-ft. span, 14 ft. roadway. Pratt Highway Truss Bridge.

For reinforced concrete abutments and wingwalls.

For plain concrete abutments and wingwalls.

Tenders must be on the prescribed form and be accompanied by marked cheque for 5 per cent. of the amount of the larger tender.

The bridge site is 3½ miles west of Paris.

Plans and specifications to be seen at the office of the County Engineer, 4 Temple Building, Brantford.

ALAN M. JACKSON,
29 County Engineer.

Tenders for Supplies

Tenders will be received through registered post only, **up to noon, on Tuesday, August 3rd, 1915**, for the supply of

58. Tie Rods and Tie Plates for Lansdowne Avenue Extension, Toronto Civic Railway.

66. Special Track Work for Lansdowne Avenue Extension, Toronto Civic Railway.

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and envelopes must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH (Mayor),
29 Chairman, Board of Control.

Sprinkler Wanted

Tenders for a motor-driven combination street sprinkler and flusher will be received by the Sprinkling Committee up to **July 29th, 1915.** For further particulars apply to G. G. Bucher, Chairman Sprinkling Committee, or A. H. Millar, City Clerk, Berlin, Canada. 29

Late News Items

Blue Sea Lake, Que.
Tenders on the erection of a summer hotel are being received by V. Leduc, Wellington and Chandire Streets, Hull. Artificial stone construction, slate roofing. Approximate cost, $8,500. Plans and specifications with Mr. Leduc.

Fort William, Ont.
John King, Victoria Avenue, has commenced the erection of two double residences, estimated to cost $10,000. Work by day labor. Frame and brick construction, stone and concrete foundation, shingle roofing.

Mille Roches, Ont.
Tenders on repairs and construction of a tower at the Chapel of Our Lord of the Sacred Heart are being received by Rev. Corbet McRae, Dickenson's Landing, Ont. Plans and specifications with Mr. McRae.

Montreal, Que.
The following contracts have been let in connection with the theatre in course of erection for the St. Denis Theatre Company, 160 St. James Street:—cut limestone, John Quinlan & Company, 4412 St. Catherine Street, Westmount; hardware, Duraund Hardware Company, 370 St. James Street; modelled plastering, M. R. Guisti, 42nd Street, New York; painting, Shagpat Studios, 6 Beaver Hall Square.

Orangeville, Ont.
Tenders on the construction of a roof at St. Andrew's Church will be received until noon, July 24th, by the Board of Managers.

Ottawa, Ont.
The City Council have let the contract for laying asphalt pavement on Somerset Street to the Ottawa Construction Company, Central Chambers, and for asphalt pavement on Nicholas Street to the Union Construction Company, Bank Street, Chambers.

The general contract for the erection of an addition to a store for R. E. Powell, 290 Elgin Street, has been awarded to Charles Hopewell, 7 Clemow Avenue. Approximate cost, $8,000.

Thetford Mines, Que.
Tenders on the erection of a residence for A. S. Johnson will be received until July 30th by H. G. James, Architect, Whiting Block, Sherbrooke, Que. Cobble stone and roughcast construction, concrete foundation. Approximate cost, $17,000.

Three Rivers, Que.
The Three Rivers Traction Company are building a street railway estimated to cost $150,000. Work by day labor.

ESTABLISHED 1886

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Corporation Employees and the War

"Shame on the false Etruscan who lingers in his home
When Porsena of Clusium is on his way to Rome!"

ONE of the members of that august body, the Institution of Civil Engineers, commends the action of the City of London Corporation in refusing to increase the wages of employees who are of military age. While not in sympathy with compulsion, he deplores the fact that in Great Britain there are a large number of men who, from one cause or another, are shirking their duty. He tells us that there are still left many men of military age doing work which could be performed equally well by old men or by women. "To encourage such men by increasing their wages at this juncture," he writes, "would be unpatriotic and ill-advised, and would be putting a premium on pusillanimity."

In this view the Contract Record concurs. There is not a little in the sentiment which applies to Canada and to conditions here. We are all interested in the idea of maintaining the business stability of the country as far as possible, and in no field of endeavour is this idea of greater appeal than in the constructional field, whose ramifications are so broad, and whose activities embrace so many branches of work, but it were treasonable at such a time to place private enterprise before the great enterprise upon which the country and the Empire are embarked. It is to be regretted that in Canada, also, able-bodied young men of military age are hanging on to their jobs in the constructional and every other field, the while middle-aged and elderly men are filling the ranks of the unemployed. Toronto and Montreal alone are harbouring thousands of men between the ages of eighteen and thirty-five, whose places could be filled, with honor to themselves and advantage to the country, by men a generation older.

Considerable Work in Progress

The German menace is not going to halt building and engineering work in Canada, and it behoves each of us to do his part in keeping business conditions on an even keel. It was to be expected that there would be a great falling-off in constructional work, but it must not be imagined for one moment that things are at a standstill. A careful perusal of these pages week by week will disclose appreciable activities on the part of both the Government and the public. The Government is doing its part and the municipalities are doing theirs, while the man in the street shows a reasonable disposition to take advantage of the unexampled opportunity of building now with economy and profit.

But, be it noted, these reflections in no wise affect the larger issue. For able-bodied men a well-defined path of duty is marked out, and there should be no need to make the way more attractive by alluring pictures of reward of any kind. For an eligible man having no disabilities, physical or otherwise, to stay at home and let others fight for him is to play the part of a poltroon, and certainly such a part should not be encouraged even to the extent of security of tenure in his employment—let alone increase of pay.

"M. Inst. C. E." concludes with these significant words: "The fact is that England is too safe, thanks to our splendid Navy and to the absence of frontiers, but there may be a rude awakening some day if the manhood of this country do not realize that every bit of energy we possess must be used in only one direction until the awful shadow, which of a surety now threatens us, is dispersed. The only way in which this can be effected is by every man of fighting age in the country taking his part in the war."

Nine-Tenths of the Advantage to America

IT is, of course, futile for laymen, or even statesmen, to talk of the terms of peace before the end of the war is in sight, writes J. E. Yerbury, in a communication to The London Builder; but, however severe they may be as against Germany (and perhaps the more severe the better for her in the long run), the rest of the world will still be faced with the competition of the German-speaking population of the Middle Empires, more closely bound together than ever before, the best organized, and the most highly commercially trained population in the world, which in a very short period after the war will compete, even more keenly than before, in all the markets open to them; and, in the opinion of many business men, the loss of her commercial supremacy will be of short duration to Germany, unless the methods (or want of method) of the past are thrown over by English manufacturing firms. And even during the period of Germany's loss it will be America and not England that will gain.

American firms are paving the way for future commercial activities, but it is doubtful if English firms are doing more than marking time during the war period. If the people of this country had only had sense enough to have listened to Lord Haldane a few years ago, when he started his crusade for better commercial education and training, we should be in a position to take up our task after the war, and even yet there may be time to prepare for the commercial war which will follow the declaration of peace.

Education and training are at the bottom of German commercial supremacy, and until we adopt a system which will meet the requirements of every class we must be content to see America take nine-tenths of the advantage lost by Germany.

The Engineer—A Constructive Criticism

AS I see it, says a writer in The Engineering News, one of the greatest faults of the engineer is that he relies too much on his technical training, and confines himself to an entirely too small a field, taking little interest in the affairs of the day outside of his own chosen profession and not mixing with clubs and organizations as other business men do.

Surely there is no business or profession which is more certainly founded upon sound business principles than is engineering. "Engineering is the theory of economy" expressed in a few words. No engineering business can ever be truly successful until it takes on a sound business system. We have often heard that an engineer is "a man who can do for one dollar what any fool can do for two." How can this be true unless, in addition to technical engineering knowledge, a man employs business methods in his calculations and transactions?

Most engineers are inclined to lack confidence in themselves when it comes to mingling with men of affairs, or else their outward demeanor does not show that this is not the case. We cannot expect to always talk "shop," and in our intercourse with men it is exceedingly important to our success that we be able to converse on other subjects. It is the big, broad man who accomplishes things in this day and age, and we must enlarge our field and become conversant with the events of the day.

We have read a great deal of late in the engineering publications on the subject of public speaking by engineers. Right here is one of the greatest failings of the men in our profession. The engineer should train himself to speak in simple, well-selected, plain words, and be able to show his hearers the advantage to the community at large of engineering works. Surely there is no other profession which should be more interesting to the public than engineering, but the great trouble has been that we have not been trained to present our side of the case.

The engineer should be versed in legal procedure, labor conditions, social problems and all general questions of city, state and country. In order to be successful, he must be able to express himself in good, clear, sound English, and not simply sit back with the air that "I am an engineer and I can make no mistakes," or "you must take my word for it, for you would not understand even if I tried to explain, because you have no technical education."

I have found that the knowledge of legal procedure relative to public improvements which are constructed from funds derived from bond issues or special assessments is one of the most valuable assets.

The writer believes that technical schools could not make a better move as an improvement in their courses than to include one on public speaking. If every student of engineering were required every so often to deliver a lecture on his subjects he would soon lose his "stage fright," and this training would be of incalculable value in life later.

A concrete barge has been in service on the Welland Canal for four and one-half years and during that time has been subjected to severe service. It is used in canal maintenance work and at times riprap, in loading, has been dropped on its deck from a height of 12 feet. The scow, which was built in November, 1910, is 80 ft. long, of 24-ft. beam and has sides 7 ft. high. The hull is divided into eight compartments by one longitudinal and three cross bulkheads. There are 2 x 2½-ft. openings through the cross bulkheads. The deck, bottom, sides and bulkheads are 2½ in. thick, reinforced in both directions by ¼-in. round rods on 2-in. centres. Beams 6 in. square on bulkhead lines, reinforced with heavier steel, as required, and braced by reinforced-concrete posts, care for the principal stresses. The concrete is a 1:4 mix, using small gravel. The boat was designed and built under the supervision of Mr. J. L. Weller, then Superintending Engineer of the Welland Canal, and now Engineer-in-Charge, Welland Ship Canal.

Investigation into the condition of the concrete in some of the forts in Belgium which the Germans took after a much shorter period of attack than was expected, appears to show that the work was by no means well executed. The last report in connection with the forts around Antwerp and also at Namur is that while the plans and positions were of the best and the ordnance used to defend the forts were beyond criticism, the steel and concrete and stone work were of poor quality. For instance, at Namur the concrete supporting one steel turret was so poor in quality that it was demolished by a single German shell.

The Fortress of Heligoland

In an interesting article which tells of how concrete and steel have been employed by the Germans in fortifying Heligoland, a writer in Ferro-Concrete observes that about a quarter of a century ago Heligoland was foolishly handed over to Germany by a Government who were so misguided as to suppose that the act would be regarded as an evidence of friendship. Far from taking this attitude, the Germans considered our action to be the result of fear, and at the same time laughed up their sleeves at our folly. To-day the German character is a little better understood by the British people, but quite recent events have shown how difficult it is for those in authority to shake off the traditional policy of trying to placate a savage enemy by kindness.

Twenty-five years ago, Heligoland was being rapidly eaten up by the sea, and the idea of preserving and fortifying it does not seem to have occurred to our peaceful rulers. As soon as the place came into the possession of the Germans, steps were taken for the preservation of the island, and its conversion into a powerful fortress for the defence of their shores and an important naval base as a menace to England.

Painstaking Construction

With their accustomed systematized patience, the Germans set about the heavy and laborious task of stopping the ravages of the sea. Groynes and breakwaters were constructed at various points to break the force of the waves and to alter the course of the currents which were undermining the cliffs. In places where the inroads of the waves were particularly threatening, granite sea walls were built, some of these being from 30 to 40 ft. high and from 16 to 20 ft. thick. Then, while these operations were in progress, the island was literally stuck together with cement grout and ferro-concrete. Thousands of tons of these materials were used for filling cracks and crevices in the cliffs, and it is stated by a visitor to Heligoland in 1912 that "the Germans went round the island just as a painter goes round a house, and filled in all cracks. and in some places they poured in 40 or 50 tons before the gaps were filled." As our readers are aware, the same kind of methodical precision has been displayed in the wanton destruction of Belgian and French towns during the present war.

Fortifying the Island

Next came the fortification of the island, which is undermined in all directions with galleries, lighted by electricity and leading to chambers in the face of the cliffs. Some of the chambers are for the operation of heavy guns and others for the storage of ammunition. The ordnance equipment is said to include several 14-in. guns and numerous 10-in. and 11-in. guns. Another interesting fact is that a considerable part of the island is protected by steel armour plating. The plates immediately outside one of the larger gun chambers are 8-in. thick and securely bolted into the rock. In order that they may escape detection the plates are painted of a reddish color to match the cliffs, and the various markings of the natural rock are so cleverly imitated that it is very difficult to distinguish the steel from the cliffs. Further, the gun emplacements are so skilfully hidden that they cannot be detected from the sea. The observation chambers are elaborately equipped with the most modern instruments and, of course, are in telephonic communication with all parts of the fortress One of the devices for range finding is a large glass screen divided into squares, and on which is reflected a large area of the sea. The exact range for each square having been exactly calculated, it would be quite easy to concentrate fire on any hostile ship whose image happened to be reflected on one of the squares.

The island is further equipped with a Zeppelin shed capable of accommodating two airships, the shed being constructed to sink into a pit so that its roof is level with the earth, and, being painted to imitate the surrounding land, the top of the shed is almost unrecognizable from a moderate height in the air.

As a naval base, Heligoland is now provided with one of the finest artificial harbours in the world, built at a cost of more than a million pounds and capable of affording safe anchorage for an entire fleet.

With their customary thoroughness and foresight the Germans have not left undone anything that would help to make the island an impregnable fortress and an effective menace to Britain.

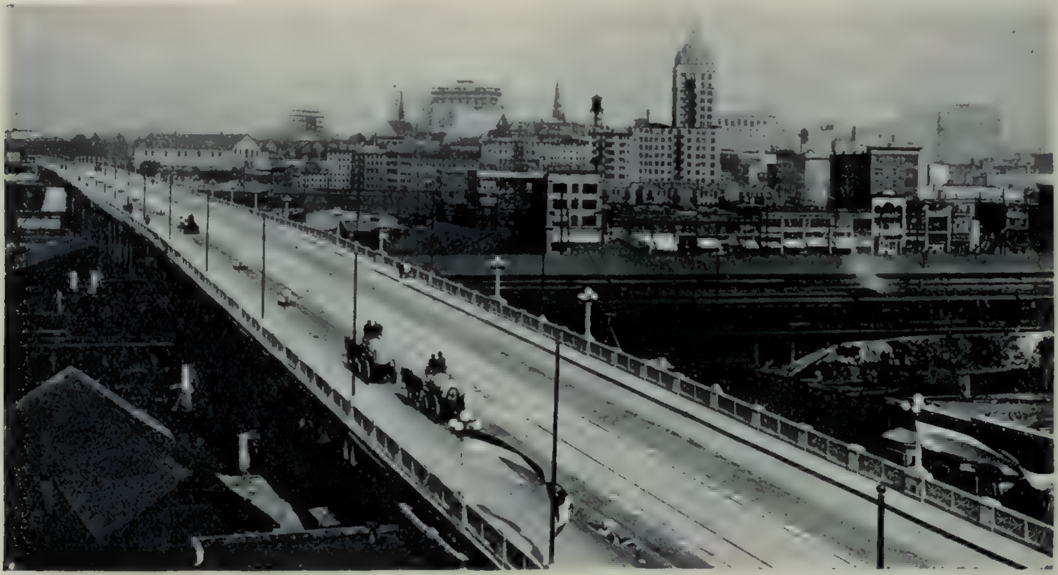
German Destruction

A pamphlet published by a Westerham printer gives a useful and complete account of the various acts of destruction of architectural monuments which have been committed by the German armies in Belgium and France, and the various resolutions of protest passed by learned and other societies, as well as the newspaper reports which have appeared in the press of various countries concerning them, the whole forming a stirring indictment of the barbarous conditions under which the German Government is waging the present war. The conditions as to the preservation of historic monuments in war agreed to by the signatory powers solemnly bind themselves to respect such buildings unless they are used by an enemy for purposes of war. The German reply in each case is either a denial that damage has been done, or else a statement that the buildings in question have been used for military purposes, and that therefore their destruction is warranted and excusable. Perhaps the most striking of all the documents referred to is the Report by Professor Clemen,, of Bonn, Chairman of the Commission on Historic Monuments in the Rhine provinces, which was written in December and published in the Journal of the American Institute of Architects in March, in which he states "that nowhere on Belgian ground have irreplaceable architectural works been lost," and goes on to explain that even among the horrors of war German art lovers may be assured that "such precious art possessions are safe in the hands of the German Government." Quotations of this kind show that it is useless to expect any recognition of the evil done or any help to prevent further damage from the German authorities, who do not scruple to describe Whitby and Scarborough as being fortified towns, and who would complacently describe the destruction of St. Paul's as a regrettable "military necessity." We do not think there is much in the suggestion made that neutralized zones should be created round historic buildings, as the policy which leads to the concentration of artillery fire on a cathedral would not regard the most clearly defined neutral zone as a greater safeguard. The real remedy appears to us to be put it beyond the power of Germany to place the peace of the world again in jeopardy, and to trust that the new boundaries of the European States which are marked out after the war may correspond with the aspirations of the people who inhabit them.—The Builder (London, Eng.).

The Georgia-Harris Viaduct, Vancouver,—the Longest Reinforced Girder Span in the World

THE completion of Vancouver's new viaduct has rounded out an exceptionally fine engineering effort in which utility, strength, beauty and economy—all duly considered—have resulted in a harmonious structure which is a feature of pride to the commercial metropolis of British Columbia.

Waterfront or port possibilities of Vancouver are in part an advantage and a handicap, for the waters of Burrard Inlet and False Creek had before the birth of the city so encroached upon the land that only a small neck permitting four highways was left to join the east and west sections of the city. Through these few streets rushed the great streams of vehicular and car traffic. Congestion resulted and a better means and more rapid intercommunication was sought.



The Georgia-Harris Viaduct, Vancouver.

The solution was found to lie in the erection of a viaduct which would not only shorten the distance to be traversed, but also permit continuous passage, an impossibility in congested areas where street intersections and the resultant cross traffic cause delays innumerable even under the effective direction of the traffic squad of police.

Construction was commenced in June, 1913, by Messrs. J. McDiarmid & Company, Limited, general contractors, of Vancouver, Calgary and Winnipeg, and completed just prior to the formal opening on Dominion Day, when this half-million dollar bridge was temporarily given the name of the Georgia-Harris Viaduct.

General Details

The viaduct, which runs east from Beatty Street to Main Street, is 2,860 feet in length, with a maximum grade of 3.11 per cent. at the east end, and 66 feet wide. Eighteen thousand cubic yards of concrete have entered into its construction, and nineteen thousand tons of steel. The roadway, which is double-tracked with 80-lb. steel rails on steel ties bedded in concrete, and which is 53 feet in width, required 1,500 square yards of paving—bitulithic and granitoid being used.

The trackage is the property of the city and will be rented to the B. C. Electric Railway Company, Limited, but it is not at present in operation, as the transportation company have been unable to complete arrangements for its use. The sidewalks are 6 feet wide, and, like the gutters, are of cement.

The spans vary from 25 to 280 feet, according to the requirements of trackage, lanes and other systems which it was desirable not to disturb, for this viaduct crosses streets, lanes, the C. P. R. and B. C. E. Railway yards, the G. N. R. depot and yards, and False Creek. Short spans are of slab or mushroom construction, and girder and continuous Warren truss construction are also used, according to the dictates of economy and needed strength. One of the spans required girders of reinforced concrete 83 ft. 6 in. in length, which is believed to be a record for bridge girder span constructions.

The actual construction cost was $500,000. This is exclusive of any amounts which have had to be paid for the removal of buildings and for other indemnity to property owners.

The whole structure is finished off with an ornamental rail, of which the lighting standards form a prominent and classic feature.

The engineers who had charge of planning and construction were:—Messrs. F. L. Fellowes, City Engineer; C. A. P. Turner, Consulting Engineer; A. P. Hueckel, Supervising Engineer; Jas. P. Kennedy, Engineer, and Thos. Borgford, General Superintendent at Vancouver for the contractors, Messrs. J. McDiarmid & Company.

Wood Block Paving in Montreal

By Dr. John S. Bates[*]

EARLY wood pavements of untreated blocks on plank foundations gave very unsatisfactory results in Montreal, as was the case in every other city where this primitive type of pavement was adopted. Pavements built in this city in the years 1889-1893 of tamarack blocks dipped in creosote gave comparatively poor service. The causes of such results are well known, and now, after years of experimenting with various methods of treatment and pavement construction, means of overcoming these difficulties are equally well understood. A short stretch of dipped block pavement remaining on St. Francois Xavier Street is an interesting relic of those early experiments. In its present condition it is of little use as a pavement, but it forms an impressive demonstration of what wood-block pavement should not be.

A wood pavement is subject to deterioration from two agencies: (1) mechanical abrasion from traffic, and (2) decay resulting from development of wood destroying fungi. It has been demonstrated during many years of experience in Europe and America that thorough impregnation with creosote oil, which acts as an antiseptic waterproof filler, affords effective protection against deterioration from both of the above causes. Without attempting to discuss in detail the various factors upon which the durability of a wood-block pavement depends, it may be said that service results obtainable from untreated or dipped blocks, where at best the penetration of the preservative is only superficial, are in no way comparable to those from blocks thoroughly impregnated under pressure, which is the universal modern practice. Untreated softwood blocks were everywhere abandoned for pavement construction long ago, and dipped blocks are now rarely, if ever, used. The use of pressure treated wood-blocks for pavement construction has been increasing consistently during the last six or eight years in European countries and particularly in the United States.

The outstanding merits of wood-block pavements are noiselessness, durability and low traction resistance. Because of these features, such pavements are particularly well adapated for busy city streets. Some of the world's most heavily-travelled thoroughfares are paved with creosoted wood-blocks. Those who have observed the wood-block pavements of the Strand, London, or of some of the famous streets of Paris or of lower Broadway, New York, must have been impressed with the excellent results there obtained. Toronto, Hamilton, and Ottawa all possess very fine examples of modern block pavements. During the last three years these cities have laid considerable areas of wood pavement with very satisfactory results, thus proving that such paving material is perfectly well adapted to Canadian climatic conditions.

There are two short stretches of block pavement recently laid in Montreal, which have been in service two years. These are located on St. Sulpice Street, south of Notre Dame, and on Bonsecours Street, south of Craig Street. While the length of service of these pavements is as yet insufficient to warrant any conclusions as to ultimate life, they will, no doubt, give very good results.

It must be significant to Canadians who are interested in the development of national industries to note that cities in England, with no native available timber, have been importing large quantities of Baltic pine for paving block manufacture and indeed have recently been investigating the possibility of securing such material in quantity from Canada. Canada has large available supplies of Norway pine, Douglas fir and other woods which are well suited for paving block manufacture, though at present less extensively used than the species named, and yet Canadian cities with a few exceptions are using a proportionately insignifican quantity of wood paving, apparently preferring to import large quantities of asphalt, asphalt block, scoria blocks and paving bricks. Surely there is a lesson in this situation for Canadian highway inquirers who are now in a position to benefit from the extensive experience of cities of the United States and Europe where wood-block paving has been sucessfully developed. It has been demonstrated beyond all doubt that wood paving is not a fad, nor is it a luxury, limited to high class residential streets. When properly laid with properly treated blocks it is a pavement which will give excellent service and the highway departments of Canadian cities would do well to carefully investigate its possibilities.

Bituminous Paving

IN a paper dealing with the re-surfacing of main roads in tar, pitch and bituminous macadam (presented at the National Road Congress, held last month in London, Eng.) the authors, Messrs. Sheldon and Lyddon, give "some of the salient points of interest on which it is considered further information is desired before more extended use can be made of the class of paving referred to as bituminous." These are seven and are as follows:—(1) The effect of various kinds of soil on bituminous material under known conditions of traffic; (2) the desirability of a strong foundation where the character of the road justifies the use of a bituminous paving; (3) the suitability or otherwise of open mixtures for use as wearing surfaces in damp situations; (4) suitable and reliable tests for asphalt cements, either by penetration or other means; (5) the desirability of analyses and tests to be made on bituminous materials for known conditions of use; (6) the allowable limits of percentage of bitumen in mixtures containing various mineral aggregates; and (7) the cause and cure or amelioration of corrugations. These are then taken seriatim, the whole forming a very valuable series of "observations." Space allows of the presentation of only a few points here. Bituminous material should not be laid where clay will come into direct contact with it, as it is kept in a more or less moist condition at all times, and this causes serious local disintegration by a general softening of the material, which is soon broken up by the traffic. The importance of a strong sub-crust cannot be over-emphasized. While unable to advance a definite opinion as to the relative water resistant proportions of the mixtures containing various percentages of mineral aggregates and bitumen, experience indicates that, of mixtures made by the same bituminous binder, those which are densest appear to be the least affected by water action. The penetration test for uniformity leaves much to be desired, and the substitution of a needle square in section would make it more reliable than at present. Data appear to be necessary, to establish the maximum percentage of bitumen which a mineral aggregate having particles of known grade will hold without the mixture becoming saturated with bitumen, and conversely, the minimum percentage necessary to withstand water action and other disintegrating agents. Corrugations appear less on mixtures laid in thin layers; rich mixtures, containing comparatively high percentages of bitumen, should not be laid in layers of greater thickness than 1 in. to 1¼ in. to reduce corrugations to a minimum. All mechanically propelled vehicles appear to exert some influence in the form of waves, but the nature of the foundation of the road is a factor of importance, a yielding foundation, other elements being equal, conducing to the production of corrugations.

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[*] In charge of the Forest Products' Laboratories at Montreal.

Progress in Sanitary Engineering

Specially contributed by Joseph Race, F.I.C., City Bacteriologist and Chemist, Ottawa

PROBABLY the most noteworthy event in the progress of sanitary engineering on this continent during the past year was the investigation of the International Joint Commission on the pollution of international waterways. Although the immediate question before the Commission is the legal one of the rights of both countries to receive water from the international waterways which shall not be injurious to health or property, there seems to be a tendency to waive a strict interpretation of the treaty and to permit such pollution as can be removed by reasonable methods of purification and that will not cause local or general nuisances. Probably riparian owners are entitled under the treaty of 1909 to water which is non-injurious to health and property in its **raw condition**, but this view seems to have been waived by all the interested parties on account of its unreasonableness and impracticability. If municipal and commercial development is to proceed, some measure of pollution must undoubtedly be permitted.

During the summer of 1913 the experts of the Commission examined all the international boundary waters, and the evidence collected demonstrates in an indubitable manner the nature, and also, in some instances, the source, of the pollution. The various reports that have been published by the Commission indicate the serious extent of the pollution at various points along the international boundary where urban communities are in close juxtaposition, but even where these conditions do not obtain, and where there is little danger of infection by other communities, the danger of auto infection by intermittent pollution caused by abnormal wind conditions still remains. It is clear that very few of the cities situated on the Great Lakes can procure a raw water supply from these lakes that can be guaranteed safe at all times. This, however, is a fact that is not yet appreciated by the public at large, and also, it must be added, by a few engineers and sanitarians. When a water supply becomes infected with disease-producing organisms and an epidemic occurs, there results a wave of action for remedial measures, but once this has passed the ebb sets in and public opinion once more subsides into lethargic indifference. Possibly the buoyant optimism of human nature—that the adverse conditions were abnormal and will not occur again—is largely responsible for this attitude. The public generally is not yet fully educated to the importance of the conservation of public health and is unwilling to spend the money necessary for this purpose. This is all the more pronounced when it is compared with the general attitude towards public works which affect the comfort of the people. Money in abundance can be found for the construction and cleansing of roadways but none for health schemes.

The investigation of the International Commission marked an important step in the advance of sanitary science in this country and it is a matter for regret that the waterways, other than international, are not being similarly treated by some department of the Dominion Government. If this were done, the Government would then possess reliable information upon which measures for the regulation of all waterways could be based. Such measures would probably be eminently practicable, in contradistinction to the provisions of the Bradbury Bill, which has been before the House for several years, and which, by reason of its striving for the unattainable, would be both ephemeral and futile. This is the view which the writer presented to the Bradbury Pollution Committee in 1913, and although somewhat unsympathetically received by the Committee, it is pleasing to note the evident intention of the Government to collect further data and opinions before enacting such drastic regulations as are proposed in this bill. The sanitary experts called upon to report on the bacteriological data collected by the Commission evidently consider that it is unreasonable to expect to obtain safe drinking water from surface streams and waterways without purification, and in this every sanitarian will concur. The natural corollary to this is the proposition that pollution of waterways should be permitted—providing that no nuisance is caused thereby, and that the amount is not greater than can be removed by reasonable methods of purification. The experts would insist on all sewage being screened in order to eliminate the larger, suspended solids, but consider treatment in oxidizing beds unnecessary on account of the general abundant sufficiency of oxygen in the waters into which it discharges. In cases where the sewage may cause unsafe loading of water purification plants, the experts recommend chemical disinfection or sterilization of the clarified sewage. The definition as to what is to be considered a safe load for purification plants is naturally a controversial point and one that must be regarded as subject to alteration as the evolution of water purification proceeds. The report shows that the experts of the Commission were divided in their opinions upon this point, although the great majority, five out of six, signed the report that the working limit was an annual average of 500 B. Coli per 100 cubic centimeters of water. The minority of one, concurred in all the recommendations of the majority report with the exception of the one regarding the safety limit for pollution, and expressed the opinion that this should be a **monthly** average of 500 B. Coli per 100 cubic centimeters. A superficial consideration would perhaps result in regarding this difference as that between tweedledum and tweedledee, but further analysis dissipates this view. Many supplies which are perfectly good purification propositions would have to be abandoned if the minority report were taken as the standard, although the present pollution might be increased severalfold before reaching the limit proposed by the majority report. This point is well illustrated in the diagram, which shows the

B. Coli in one of the best known Canadian rivers. The writer is of the opinion that although the monthly average basis of estimation is too severe in effect and ignores the fact that such waters can and are producing satisfactory supplies, the annual average method of computation is too lax and requires qualification or modification. If the index of pollution does not fluctuate very largely, the annual average of 500 B. Coli per cubic centimeter could be permitted without an undue strain upon the purification process, but if the difference from the mean are large, the factor of safety is considerably reduced. If the annual average basis were qualified by a clause providing that the B. Coli index shall not exceed a specified maximum during a limited duration of time, the report would meet with unqualified approval.

The investigation as a whole has been of immense importance, because it has shown the lines along which future developments in sanitary engineering are to follow for at least some years. The activities suggested are, primarily, water purification, and secondarily, the screening and chemical disinfection of sewage.

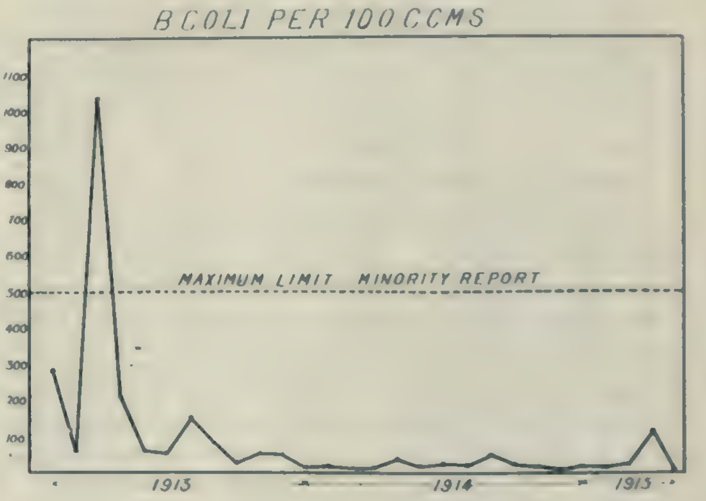
Water purification during 1914 has shown no radical alterations, the chief feature of the year being a tendency to increase the safety factors of plants by treatment with chlorine. This practice is now almost universal on this continent, over 400 millions of gallons a day being treated in this manner.

Liquid chlorine has been reported upon very favorably by several observers, and has, in some instances, been substituted for hypochlorite of lime. The superiority of this substance over hypochlorite to the amounts claimed by various people has yet, in the writer's opinion, to be substantiated. The secret of successful chlorination lies in efficient mechanical admixture, and whilst this has often been overlooked in the older installations using hypochlorite the full advantage of it has been utilized by the recent liquid chlorine installations.

The writer has followed this matter very closely and has found that considerable economy could be effected by close attention to this detail. At Ottawa he found that excellent results could be obtained by the use of hypochlorite of lime in the proportion of 1.5 parts per million of available chlorine, whilst in Montreal it was found by Harrington that a similar amount of chlorine was required when added as liquid chlorine for the treatment of the water of the Ottawa River. The excellent automatic chlorination controllers that are attachable to the Venturi meter recorders also guarantee a much better adjustment of dosage than can be obtained with liquid chlorine. The use of liquid chlorine is only justifiable when the increased cost of chlorine can be counterbalanced by reduced labor charges, or when local conditions do not permit the use of the hypochlorite of lime.

In water filtration the year was marked by the award of the Toronto extension to a company which is building filters of a rather radical type. This filter, the drifting sand type, combines principles common to both slow sand and mechanical filters, and if the results obtained on the large installations even approach those obtained with the unit experimented with at West Toronto, water purification will be revolutionized. The possibilities of this type of industrial purposes, and especially for paper makers, should be seriously considered. One of the essential features of this filter, and also of others well known in this country, is the elimination of the coagulation basin, with a consequent large saving in capital expenditure. Some sanitarians have held that considerable time is required for the production of a "floc" in water by the addition of alumina sulphate, but the writer has proved in a series of experiments, made in connection with a design for a plant for the Ottawa water, that the reaction is practically instantaneous. Although no floculation visible to the naked eye is produced in less than fifteen minutes, the reaction has taken place and the products of it can be removed by filtration. In selecting a mechanical filter design, however, due consideration must be given to the amount of impurities to be dealt with, as it is conceivable that these may be so large as to reduce filter runs to impracticable lengths, unless previously removed in a sedimentation basin.

During the past year the design of the slow sand filtration plant under construction at Montreal has changed to that of rapid filtration on account of the excessive increase in the capacity demanded by the increased consumption. It is singularly unfortunate that this has been necessitated and that there will be no large-sized plant of this type operated under normal conditions in this country. The other plant of this design, that in Toronto, has been so excessively overloaded that the merits of this system have never been tried out under fair conditions in this country.



Standardization of water statistics is another important feature of the past year. The Committee of the New England Water-Works Association that has this matter in hand has issued various forms for the standardization of data which should prove invaluable in the future if their adoption becomes general. Comparisons between different municipalities in the past have been very difficult, but the forms proposed eliminate largely this, and although considerable time and trouble may be involved in their preparation, every sanitary engineer should assist and co-operate in this movement.

The efforts of the Water Consumption Committee of the American Water-Works Association should also be encouraged. This committee has endeavored to obtain statistical data from various cities regarding the water-works undertakings and has tabulated and published the replies received. These tables show that the methods and practices of water-works are very far from uniform and that in many cases the water-works department is bearing a financial burden that is a legitimate charge upon the general rates. This is well illustrated by the payments or non-payment, usually the latter in cities where the water-works is publicly controlled, for hydrants. These are part of the means for securing fire protection, and although they are constructed and maintained by the water-works departments these charges should be transferred to the general rates. Private companies invariably secure compensation for such fire protection services, and in a few cases municipalities also derive some income from this source. The great majority of Canadian municipalities, however, do not contribute one cent to the water-works department, either for fire service or for water used in other municipal departments. The reason for this procedure is to be found in the fact that many properties which are exempt from the general rates are assessed for water rates, so that if a portion of the water-works charges were transferred to the general rates, the increase in the general tax rate would be greater than the reduction in the water rate—owing to the transferred charge being derived from a smaller assessment. If a test case were carried to the courts on this method of financial manipulation, a readjustment would possibly have to be made, but as the amount involved is small on each individual property, though relatively large collectively, years may elapse before legal proceedings occur.

The statistics for water consumption in various cities, as published by the committee, show that although those places having a large percentage of metered tapes usually show a low per capita rate, the rate is by no means proportioned to the percentage of meters. It is evident from the figures published that meters are but one of many solutions for the excessive per capita consumption problem.

The most important advances in sewage disposal have been in the direction of rapid oxidisation of sewage without the use of ordinary contact beds. Although nothing has been attempted in this country, several experiments are being conducted in the United States along the lines of the Manchester experiments of Ardern and Lockett. This method consists in the preparation of a sludge which promotes active nitrification and the addition of this activated sludge to the sewage, through which is blown large volumes of air. This process can be regarded simply as oxidation by air assisted by the catalytic agency of the activated sludge. As previously indicated, future developments in sewage disposal will consist essentially of screening and disinfection, but if the new oxidation process can be worked out at very low costs, there will be a large field for it as a preliminary to disinfection. The cost, however, must be less than that of the reduced amount of disinfector required.

The Dublin process of sewage purification, which consists of the addition and cultivation of yeasts (Saccharomycetes) on the sewage in suitable tanks, is not likely to be successful on this continent on account of the greater capital expenditure necessitated by the larger per capita volume of sewage, and also because the weaker sewage would be less suitable for yeast reproduction which is essential to the success of this system.

Various methods for the treatment and utilization of sewage sludge have been proposed during the past year, but as yet they have failed to produce practical results. These processes, like many others that have been advanced in the past, endeavor to utilize the nitrogen and phosphate content of the sludge by concentration and conversion into fertilizers. The proportion of these valuable constituents in ordinary domestic sewage sludge is so small, however, as to render concentration unprofitable, and until some entirely new process for the elimination of the high carbonaceous content can be secured, the old method of lagoon drying should be retained.

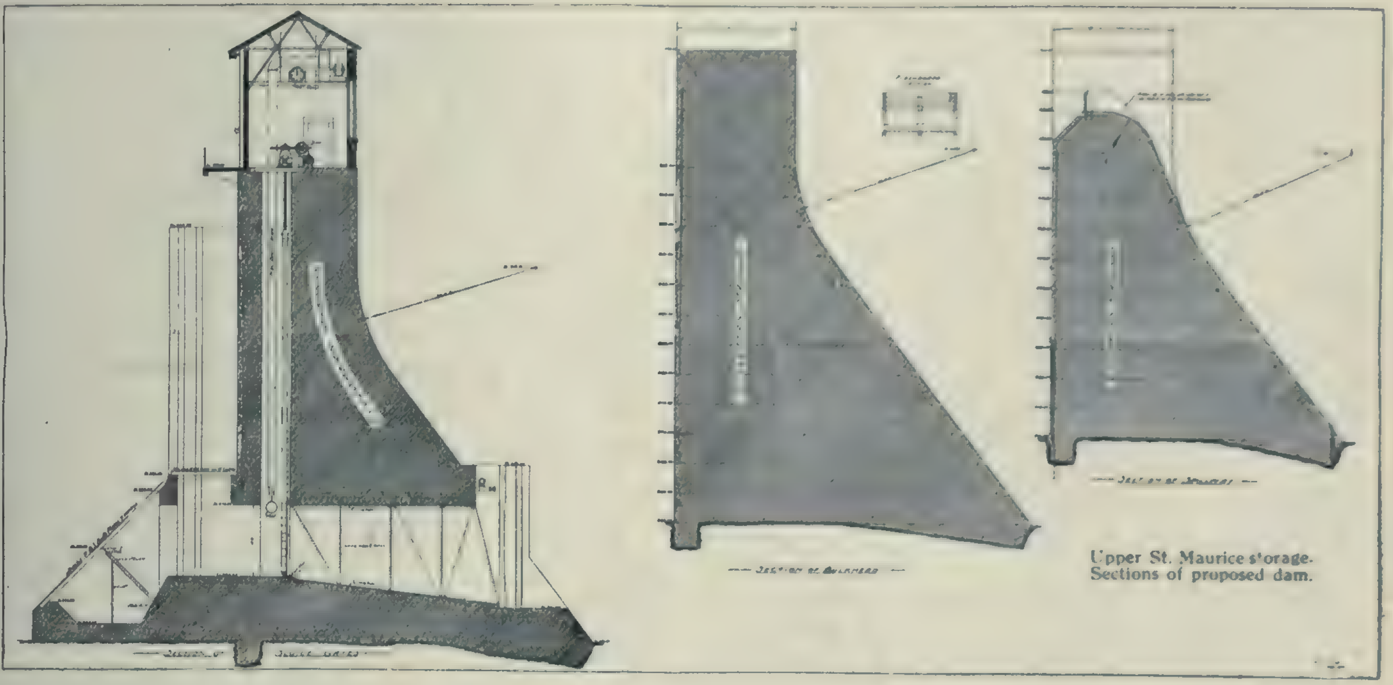
The economics of sewage treatment is a subject at present under consideration by the International Commission, and valuable results may be expected in the immediate future. This problem is one of immense magnitude and involves such enormous financial issues as to demand the attention of all who are interested in public health, if it is to be brought to a successful issue. Even if only general principles for the guidance of municipalities are the outcome, it will be an important advancement in sanitary progress.

During the year 1914 Mr. F. S. Krug, City Engineer of Cincinnati, made a service test of split granite blocks on a section of roadway 100 ft. in length. The results of this experiment were so satisfactory that Mr. Krug intends to resort to this plan whenever it becomes necessary to relay a granite block pavement. Briefly, the plan consists of splitting the old granite blocks into two equal parts which are relaid with the new surface exposed to traffic. The blocks are readily split, to form the new paving stones, by the use of hand tools. Besides possessing obvious economic advantages this plan makes a solid pavement and one less noisy than the one replaced. The surface formed is as smooth as is required for the heavy traffic common to granite paved streets.

The suggestion has often been made that steel should be painted before being embedded in concrete, with the idea of protecting the metal from corrosion. An investigation of this proposal has been conducted by Mr. H. A. Gardner, of the Institution of Industrial Research at Washington. One of the results brought out was the important fact that painting may have a distinctly prejudicial effect. One serious objection to the use of paint in reinforced-concrete work is its interference with the natural adhesion bond between the steel and the concrete. It is true that painted surfaces may be improved by being coated with crushed quartz or fine sand, but even then the presence of the paint is objectionable because it is interposed between two materials capable of entering into chemical combination, resulting in the formation of a rust-resisting compound which adds very greatly in the efficiency of the bond.

In connection with a factory building which has just been erected at Windsor, Ont., the method of floor construction is of more than passing interest. The walls of the structure are of brick, while the floor is of concrete, the latter being on a level with the concrete foundation. Below the floor level is a 3-ft. fill of gravel, which is laid as follows: A dam of sand was built around an area of convenient size, and this area was flooded with water and the gravel sprinkled with it. The height was raised in this manner 1 foot over the entire area of the building, and the operation twice repeated until the desired 3-ft. raise was accomplished. The point is made that as a result of this method of washing the gravel a very hard fill was secured. On top of this is a covering of maple flooring fastened to sleepers embedded in the concrete.

It takes the West to breed optimists. A trip over the prairies convinces Mr. George Bury, Vice-President of the C. P. R., that Canada will have a 240-million-bushel wheat crop this year.

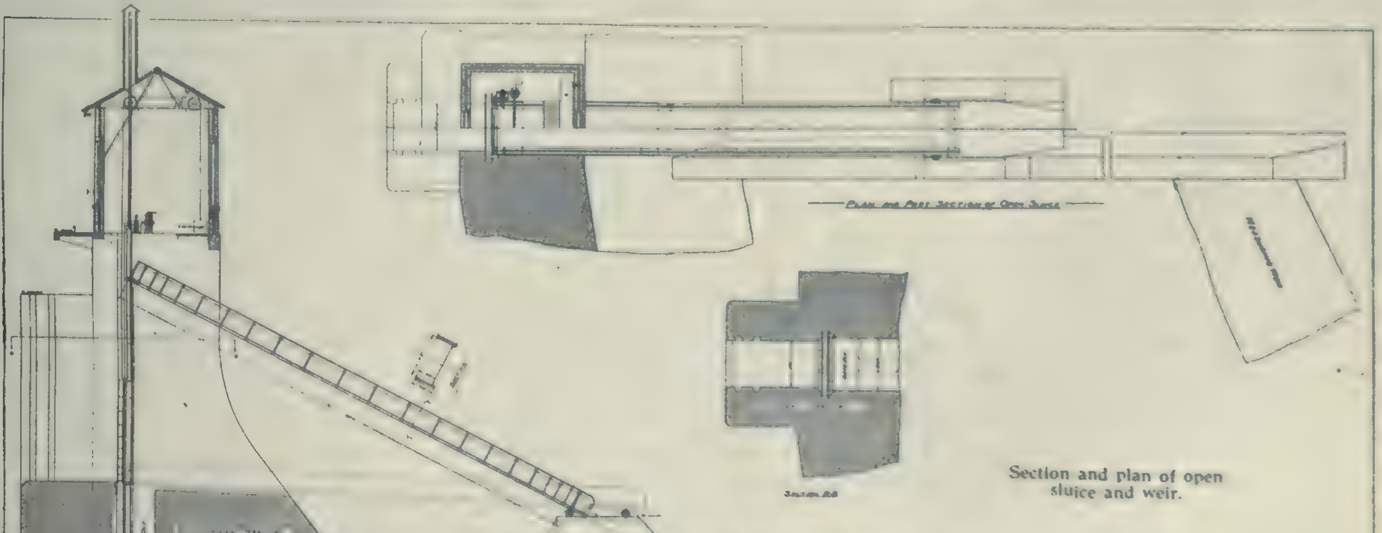


Upper St. Maurice storage. Sections of proposed dam.

La Loutre Dam to Cost One and One-Half Millions

NINE tenders were received for the construction of La Loutre Dam on the St. Maurice River, at the mouth of the Manouan River, P. Q. The contract has been awarded to the St. Maurice Construction Company, Limited, of which Mr. Julian C. Smith, of the Shawinigan Water & Power Company and the Cedars Rapids Manufacturing & Power Company is President. It is understood, however, that the actual work of construction will be carried out by Fraser, Brace & Company, Limited, of Montreal. The contract price was $1,425,000, and the work, which will be commenced at once, is to be completed by January 1st, 1918.

The object of the dam is to store the waters from a drainage area of 3,650 square miles, the St. Maurice River having a basin of 17,000 square miles. The minimum flow at Shawinigan under present conditions is 6,000 sec. ft., but when the dam is completed the minimum flow at the same place will be 12,000 sec. ft. The dam is to be of the gravity type, mass cyclopean concrete. The upstream face will be vertical, and the downstream face will have a slope of 9 inches hori-



Section and plan of open sluice and weir.

zontal for 12 inches vertical from elevation 1,318. The plans show the length of the dam to be 1,720 feet, with a width of 20 feet on the top at elevation 1,335 and 60 feet at the base, elevation 1,355. It will rest on solid rock entirely.

A spillway to be provided at the eastern end will be 840 feet long. The flow will be regulated so as to maintain a minimum of 12,000 sec. ft. at Shawinigan through ten sluice gates, 12 feet high by 7 ft. 6 in. wide, located between elevations 1266 and 1278. The gates, which will be 20 ft. centre to centre, are to be made of structural steel, and will slide on a bronze surface. They will be operated by hand power only. These gates have been designed by the Dominion Bridge Company, and will be made by them. Stop logs can be used in case of repairs to the gates. In addition to the gates a log sluice opening will be provided. This will be closed by a structural steel gate. The logs will be passed from the level of the water in the reservoir to the level in the lower pool through a log slide, which can be lowered or raised according to the water level.

The original design provided for a generating station at the dam, but this portion of the scheme has been abandoned and is not included in the contract just let. The hydro-electric company will benefit considerably from the storage scheme. This will increase the power at Shawinigan over the low water year of 1906 by 32,000 horse power and will double the low water possibilities of the St. Maurice River at that point. The owners of water powers will pay an annual amount to the Quebec Government for this additional power, and agreements have been made which will insure an annual revenue more than sufficient to pay for the maintenance charges and the capital cost. The lumber interests will also benefit, as the dam will give a more regular flow of water, enabling the logs to be driven with greater certainty. The lumber companies will be called upon to pay an annual amount proportionate to the benefits derived.

The type of dam adopted was proposed by Mr. Edward Weggmann, consulting engineer, of New York, the details being worked out by Mr. J. W. Thurso, hydraulic engineer, New York. All the information and data regarding the site of the dam, the nature of the foundation, the flow of the river, estimates of the cost of the work, etc., were collected under the direction of Mr. O. Lefebvre, Chief Engineer of the Quebec Streams Commission, who will supervise the work of construction.

The Adequacy of Bituminous Roads*

By G. H. Jack, County Surveyor of Herefordshire

IT is not possible to treat such a subject in a general way, for the reason that the conditions vary in every county, in every district, and indeed upon almost every line of road. A method highly successful under one set of conditions is a failure under another set, so that it is not safe to follow any lead without first becoming fully acquainted with all the factors, favorable and adverse, which exist upon the particular line of road to be dealt with. Experience as to the behaviour of bituminous surfaces is so varied, generally, as to point unmistakably to the fact that efficient and economical roadmaking and maintenance can only be assured by a very thorough knowledge of local conditions, and a mastery of such important considerations as the stability and drainage of the subsoil upon which the road is constructed, while unless new roads rest upon good natural or made foundations the behaviour of any bituminous surface is uncertain. Now-a-days, the choice of first-class surfacing material is very restricted, and there are not more than a half-dozen types which have successfully stood the tests which have been imposed by mechanically propelled traffic. There have been few contributions dealing with the subject of subsoils and road foundations. There is very little useful information to be derived from text-books, and what information is given is so meagre and expressed in such general terms as to be useless in practice. It therefore remains for every engineer to investigate and deal with the subsoil difficulties peculiar to his own sphere of influence. Whatever other influences there may be at work, he says, the widely different behaviour of Tarmac, tarmacadam and tar-grouted macadam "is largely due to the degree of density procurable. Where broken stone or slag is used, whether water or tar-bound, it is always noticeable that the quantity of binder taken up by the coating varies considerably, due to the space between the stones being greater in one spot than another. It is quite impossible, therefore, to expect in the case of tar-grouting an even distribution of the binder. As a consequence all tar-grouted roads soon show harsh patches, which become loose and troublesome under a moderate traffic. If the texture of the road varies, the wear must necessarily vary, and although patches of roadway remain quite good, other and adjacent patches are undoubtedly bad. As soon as this condition arises recourse is usually had to surface tarring, which heals the sores for a time but does not remedy the fundamental defect. It is the same to a much lesser degree with tarred macadam, although still less so when limestone is employed as against granite, for the reason that in the process of rolling the limestone crushes somewhat, and thus reduces the space between the stones. . . . . In the case of Tarmac, the interstitial space is reduced to a minimum, partly by reason of the properties of the slag and partly because it crushes slightly under the roller, which gives a hard and compact surface; such work is practically waterproof and therefore durable, but unfortunately rather slippery under certain climatic conditions. Slipperiness, however, is an accompaniment of all the best-known surfacing methods." As to corrugations, the author has noticed that the more yielding the binder the more wavy the surface becomes. "The corrugations are no doubt partly due to the rolling in the first place, but to a much less extent than the subsequent rolling and pushing of the traffic. The trouble is certainly not entirely due to the steam rolling, which is proved by the wavy appearance of hand-laid asphalt surfaces. It seems to me that all roads constructed of materials which have not the rigidity of granite setts or wood blocks, or lack the elasticity of such a material as rubber, must develop corrugations as a matter of course."

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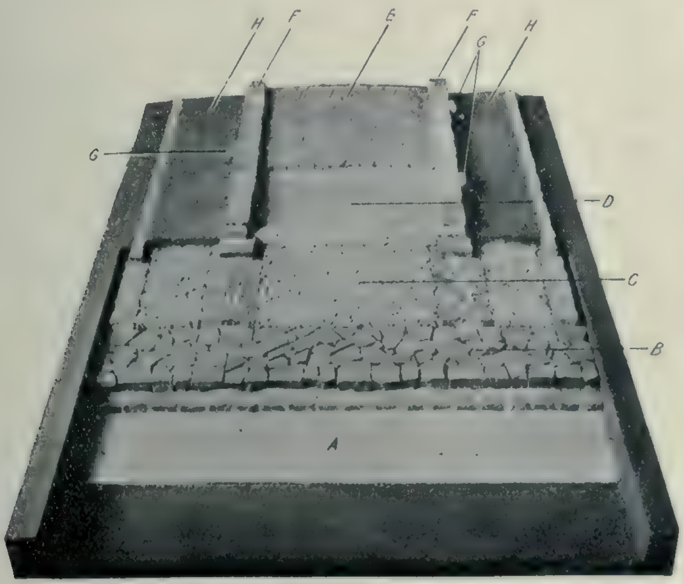
* Abstract of a paper presented last month in London, at the National Road Congress.

Roman Roads

THE Romans began building roads on a large scale more than three hundred years before the Christian era. The Appian Way, one of the most celebrated of their roads, was begun in 312 B. C., by Appius Claudius Caecus. This road led from Rome to Capua, a distance of 142 Italian miles. It was later continued to Brindisi, making the total distance 360 miles. Rome continued as a great road-building nation for about six hundred years, and fragments of some of its roads still remain. The Appian Way is said to have been in good condition more than eight hundred years after its construction.

The Roman construction was not uniform, though always extremely massive. The general form of construction employed during the reign of Caesar Augustus, when Roman road building seems to have reached its height, was a massive road from 16 to 30 feet wide, from 3 to 4 feet thick, and laid in 3 or 4 courses. The first course was almost invariably of large, flat, field or quarry stones laid on the earth subgrade, except in swamps, where poles, logs, brush, or even boards were used beneath the stone course. The other courses varied extremely with the available material and the period and importance of the road. Either small stones, with and without mortar, or gravel, broken brick, tiles, etc., were used for the second and third courses. The surface or wearing course consisted of well-cut, irregular, close-fitting polygonal blocks on a few of the more important roads, but more often it consisted of uncut stones, not unlike our cobblestone pavements, or of gravel, and in some cases of a mixture of sand and clay or clay and gravel.



From a photograph of a model of the Appian Way (300 B.C.)

Some of the more important roads near Rome were practically lined with temples, porticoes, and statues. On all roads inscribed milestones were placed at regular intervals.

The accompanying illustration shows a model of the Appian Way—the highest type of road constructed by the Romans. This model was exhibited recently in Toronto, at the last Canadian and International Road Congress.

Section A shows the contignatum pavimentum, composed of lime and sand, straw, rushes, or reeds, and sometimes laid on sills or boards.

Section B shows the statumen, or foundation, composed of two courses of flat stones laid dry or in lime mortar. The depth of this course was from 16 to 18 inches.

Section C shows the rudus, or rubble, composed of broken stone mixed with lime in the proportion of 1 part of lime to 3 parts of stone. Sometimes the material was taken from old buildings. This course was laid from 6 to 9 inches deep.

Section D represents the nucleus, composed of coarse gravel and lime used hot, or bricks, potsherds, or broken tile mixed with lime and covered with a thin layer of lime mortar.

Section E shows the summa crusta, or pavimentum, consisting of polygonal blocks joined with the greatest nicety. This course was about 6 inches deep and about sixteen feet wide.

Section F indicates the curbs, which were 2 feet wide and 18 inches high, with mounting blocks as shown at G. These blocks also served as seats for travellers.

Section H shows a side road, the surface of which was composed of gravel flushed with mortar. The width was from 6 to 8 feet.

Gravel roads in Kansas cost from 20 to 60 cents per square yard, averaging about $2,500 per mile for a 10-in. surface 16 ft. wide, where the haul does not exceed 2 miles, according to the latest annual report of W. S. Gearhart, State Engineer. Oiled earth roads cost from 10 to 20 cents per square yard, averaging about 15 cents. Waterbound macadam roads vary in cost from 45 to 60 cents per square yard; a waterbound macadam road 16 ft. wide, and with a surface 8 in. thick after rolling, will cost approximately $5,000 per mile under normal conditions. An oiled or bituminous macadam road costs from 10 to 25 cents per square yard more than waterbound macadam. Concrete paving costs from $1 to $1.30 per square yard. Brick roads cost from $1.50 to $2.25 per square yard, averaging about $1.75 where the haul is short. Sand clay roads cost from $300 to $1,500 per mile for a 12-in. clay surface 16 ft. wide, the average cost being $800 per mile.

In the borough of Manhattan, New York City, the use of a sand cushion for granite blocks has been abandoned, according to information received from Mr. Eugene W. Stern, Engineer of Highways. Under the 1915 specifications a mortar bed is used consisting of one part Portland cement to three parts sand, mixed almost dry. The blocks, it is said, are brought to a proper surface by ramming just as readily as when the old sand cushion was used. The mortar hardens in a few weeks even under traffic. The great advantage of the mortar bed over the sand cushion, Mr. Stern states, is that surface water leaking through the joints of the blocks does not cause depressions in the surface, which was the case with the sand cushion, and the cost of maintenance is considerably reduced thereby.

A report by the general passenger agent of the New York, Westchester and Boston Railway includes the following statement:—"The multiple-unit coaches operated by this company weigh about 65 tons each, yet the passage of a train over a viaduct having a concrete bed is practically noiseless."

Data and Discussion on Leakage from Cast Iron Water Mains[*]

WATER leakage and waste may properly be divided into the following classes: (1) House or inside leakage due to defective plumbing. (2) Over-consumption, especially in summer. (3) Water stolen from the mains, and waste due to flat rates. (4) Underground leakage from services and mains. The first three sources of waste can and should be regulated by the installation of meters. This leaves only the underground leakage from services and mains for special consideration and serious study. During recent years several large cities have made exhaustive studies of the whole subject of water waste. The data here given will be confined to those pertaining to underground losses.

At Baltimore 60 per cent. of the leakage is charged to defective house connections, 20 per cent. to broken supplies, services and private pipes, and 20 per cent. to mains, valves and water used in street construction. These figures pertain to the high sections of the city and it was thought very likely that leakage from the mains direct would be found much higher in the lower parts of town. In New York City, in Manhattan and the Bronx, the waste detected and stopped from the fall of 1910 to April, 1913, was approximately 40,000,000 gals. per day. The underground leakage detected and stopped was about 25 per cent. of the total.

Very complete and thorough tests, extending over seven or eight years, have been made in the city of Washington. The data on underground leakage are so itemized as to show exactly the amount of loss from the different sources. During the seven years from July 1, 1907, to July 1, 1914, the underground leakage detected and prevented averaged 5,759,200 gals. per day. This was distributed as follows:

Sources of leakage.	Average daily leakage detected and prevented. Gallons.
1. Abandoned taps and services	140,843
2. Iron services	1,702,643
3. Lead services	611,600
4. Wiped joints	380,171
5. Couplings	825,871
6. Stopcocks	33,057
7. Street washers	8,371
8. Joints on mains	1,183,943
9. Broken mains	262,486
10. Valves	47,514
11. Blow-offs	142,986
12. Fire hydrants	51,100
13. Public hydrants	23,914
14. Unclassified	346,200

The foregoing tabulation shows the two principal sources of leakage to be from iron services and joints on mains. The former comprises approximately 29 per cent. of the total loss, or in other words the two combined represent one-half of the entire leakage. The loss shown in the case of couplings (which is the next largest) practically all occur in one year (1908-1909). Hence it is hardly fair to give this much weight. The loss from such a source should never be excessive. In most cases it is almost negligible. The losses both from lead services and wiped joints, while varying to quite an extent for the different years, are seen to be sufficiently large to warrant serious consideration. The other losses are rather variable and are not of so much importance.

The cases of Baltimore, New York, and Washington may be taken as typical. The results obtained indicate that the underground leakage represents anywhere from 25 per cent. to 51 per cent. of the total waste, but it must be borne in mind that the figures quoted represent only the amount of waste that was detected and stopped. Just what proportion of the waste was not detected or prevented we are not told, except in the case of New York. Mr. De Varona states that this represents only 15 per cent. to 20 per cent. of the total pumpage unaccounted for. Now in making such surveys as this it is much easier to detect leakages from services and house fixtures and waste occurring inside buildings than it is to detect leakages from the mains proper. As a matter of fact there is no reason why all inside loss could not be absolutely determined and this at a low cost. It would be a little more expensive to make such an investigation of the underground services, but this could also be done and the leakage from such a source determined. Then it is only reasonable to suppose—say in the case of New York for instance—where only 15 per cent. to 20 per cent. of the waste was actually accounted for, that a much larger percentage comparatively of the inside loss would be located and stopped than that of the leakage occurring underground, particularly from the mains themselves. As previously stated, if a water works system is properly metered, the inside waste ceases to enter into the problem. When a consumer is paying so much per thousand gallons for the water he uses, he will see that the plumbing is in good shape and that over-consumption is stopped.

It is a very difficult matter and in many cases practically impossible to make a close examination of the mains underground. This would necessitate the tearing up of paving, as well as otherwise seriously disturbing street traffic. Such a condition would not be tolerated in a large city, and even if they were willing to suffer the inconvenience, the work itself would be too expensive. This leads the writer to conclude that in most cases the leakage from mains greatly exceeds the amounts which the surveys indicate. Where the soil is porous and the street well paved, particularly with certain substances like concrete or asphalt, a leak even of considerable size from the main would not be detected on the surface. The water could easily find its way to a sewer and would remain undiscovered indefinitely. There might be numberless leaky joints that would thus pass unnoticed. Even a careful examination of the system, unless the pipe were actually uncovered and examined, would fail to disclose the location of these, except in a general way. Hence it is almost impossible to determine the exact underground leakage from mains and the rather low percentage of loss from this source as shown in the report cited is probably accounted for in this way.

Recently Walnut Street, one of the principal thoroughfares of Kansas City, was repaved in the heart of the business section. There is a large supply main down this street and the writer observed that the city was going to the expense of uncovering the joints in this main and recaulking them. Unfortunately the writer has been unable to learn just the extent of leakage that was found and does not believe the city could furnish these data, but, since they went to considerable expense to repair the main, it is only natural to conclude that they felt the loss fully justified the cost of the work. The few joints that the writer examined showed that leakage did exist.

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[*] From the report (published by Engineering and Contracting) of a paper presented at the recent annual meeting of the South-Western Waterworks Association by Joseph W. Ivy, of the American Cast Iron Pipe Company.

No matter how carefully joints are made, even by skilled workmen, a certain amount of leakage will always be found to exist. In a paper read before the New England Water Works Association September 9, 1914, Mr. E. G. Bradbury presents some very interesting data on the subject "Allowable Leakage from Water Mains." From a series of tests made by Mr. Bradbury on a large quantity of pipe laid under his supervision at Akron, Ohio, and also at some other points, he proposes as a standard of allowable leakage in newly laid cast iron water pipe an average of 100 gals. daily per mile per inch of diameter of each complete contract or district with a maximum limit of 200 gals. daily per mile per inch of diameter. Mr. John H. Gregory specified at Columbus, Ohio, a permissible leakage equalling approximately 520 gals. daily per mile per inch of diameter, and justified this allowance with the statement that "the limits of allowable leakage specified were not guessed at, but were determined after careful study of the measured leakage in pipe lines with which the writer was familiar." The New York Aqueduct specifications allow a loss of 2 gals. per foot of lead joint, which is equivalent to approximately 240 gals. per mile per inch of diameter. Burns & McDonnel, of Kansas City, who have supervised the construction of some three or four hundred water works systems throughout the Middle West, in their tests allow a leakage of 80 gals. per mile per inch of diameter.

Now if we make an average of the allowances as prescribed by the authorities cited above, we find this to be 235 gals. per mile per inch of diameter. This, it must be borne in mind, takes into consideration only the actual leakage from the joints of the mains themselves where these mains are freshly laid and, therefore, at their best. Pipe systems necessarily become less efficient with age and the natural tendency would be for this joint leakage to increase with age. Just what the amount of this increase would be, it is almost impossible to determine, for as already explained, main joint leakage is so distributed as to make examinations, tests and repairs practically out of the question. However, this does not lessen the serious losses that now occur.

Unless applied to some concrete example, figures such as the above do not mean a great deal. Hence for the sake of illustration the writer will apply these to a city of, say, 100,000 population. In such a town the average diameter of the pipe would probably be about 10 ins. The amount of mains, say, about 200 miles. The loss per day would be 470,000 gals. The loss per day would be 470,000 gals. Figuring the production cost of the water at $50 per 1,000,000 gals., this would represent a loss of $23.50 per day, or $8,577.50 per year. Allowing 6 per cent. for interest and sinking fund, this would capitalize at $142,958.

This, now, represents only the **minimum** loss from **joints** alone in a newly constructed system, which is supposed to be built in the best manner possible. With age, even in a properly constructed system, joint leakage undoubtedly increases. The writer believes that during the life of the ordinary system, it would be only fair to average the loss at double the minimum when first tested, or say place the total joint leakage at 500 gals. per inch mile per day. Apply this to the foregoing case, we find the yearly loss to be $18,250.00, or at 6 per cent., an investment of $304,166.66.

Now in addition to the joint leakage we must take into consideration the following sources of underground loss: 1. Hydrants and valves. 2. Service connections. 3. Leaks, defective mains, dead ends, and "sweating."

In a paper read before the American Society of Civil Engineers, the late Emil Kuichling (Trans. Vol. 38), set the well known standard of one drop per second from each joint on a main; five drops from each hydrant or valve; and three drops from each service pipe, as a fair average in a properly constructed system. Now whether or not we may differ with Mr. Kuichling as to the actual loss per second, the ratio assigned by him seems to be well taken and tests tend to verify this. Hence the writer feels justified in making use of it here.

Most pipe in use at the present time is made in 12-ft. lengths. In the case of the city previously cited with 200 miles of mains, this would mean 88,000 joints. Figuring a service connection every 65 ft. would give us a total of 16,240 connections. Estimating a hydrant or valve every 300 ft. gives us a total of 3,520. By applying the ratio of leakage suggested by Kuichling, and reducing to the same unit, we have:

Pipe joints .. .. 88,000 x 1 = 88,000 units
Service connections ... 16,240 x 3 = 48,620 units
Hydrants and valves ... 3,520 x 5 = 17,600 units

Or, letting 100 per cent. represent the three sources of leakage, we find same to be divided approximately as follows:

Pipe joints	56 per cent.
Service connections	33 per cent.
Hydrants and valves	11 per cent.

Taking the value of 500 gals. previously determined in the case of pipe joints, we arrive at the following results:

	Gals. per inch mile per day
Loss from joints on mains	500
Loss from service connections	300
Loss from hydrants and valves	100

This brings us to the question of leaks by reason of defective or cracked mains, dead ends and "sweating"—a very hard thing to determine exactly in a general way because what is true in the case of one system might not be true of another—hence any loss that is assigned to such sources is much in the nature of an expression of opinion. There is little to substantiate or prove what might be said. However, as to defective mains, experience has shown that this need not be considered in the case of cast iron, once they are thoroughly tested and accepted, for there does not seem to be any case on record where they have rusted out under ordinary conditions, even after a century or two or service. There is doubtless in many cases considerable leakage at times because of cracked or broken mains, but such losses are only temporary in most instances as they are easily discovered and repaired, therefore the loss is not serious. The writer can find no reason for believing that dead ends are a source of much waste, yet some authorities seem to think—just why it is hard to understand, provided the system is properly inspected. The question of "sweating" seems to be a debatable one; certain tests made at Philadelphia several years ago on a 24-in. main under a pressure of 200 lbs. indicate that this is rather large. The writer has been unable to find any other tests to bear this out in the case of ordinary pressures. Under high pressures—say 1,500 to 2,000 lbs. to the square inch, there is quite a noticeable tendency for the water to be forced through the walls of the mains, even in the case of cast iron where the metal is an inch and a quarter or more in thickness.

Now, as previously stated, the loss from the causes enumerated and discussed in the foregoing paragraph is largely a matter of local conditions and, at best, only the expression of a personal opinion of what the loss should be. In the case of a well built system, properly kept up, the writer considers a loss of 100 gals. per inch mile per day as a liberal allowance from such sources. Assuming this, then, as being a fair estimate, we have losses from legitimate sources (no account is here taken of "steals" from mains, because it is a question that cannot be properly dealt with as applying generally) determined as follows:

	Gals. per inch mile per day.
Loss from joints on mains	500
Loss from service connections	300
Loss from hydrants and valves	100
Loss from other sources	100
Total	1,000

Applying the above results to the concrete example previously cited, i.e., to a city of 100,000 inhabitants with an estimated length of 200 miles of mains, average diameter 10 ins., water cost of $50 per 1,000,000 gals. and money figured at 5 per cent. for sinking fund and interest:

Source of loss.	Loss for yr. in gals.	Value at $50 per million gals	Represent at 6% an investment of
Joints on mains	365,000,000	$18,250.00	$304,166.66
Service connections .	219,000,000	10,950.00	182,500.00
Hydrants and valves	73,000,000	3,650.00	60,833.33
Other causes	73,000,000	3,650.00	60,833.33
Totals	730,000,000	$36,500.00	$608,333.32

In other words, the city would be justified in spending $608,333.32 to save the leakage from the mains, and a proportionate amount to reduce it. Of course it is almost a physical impossibility to make the mains "bottle tight," but it is possible to reduce the leakage materially.

The writer understands that several manufacturers are either making at the present time, or preparing to make, pipe in 16-ft. lengths. Under the circumstances it would not be amiss to call attention to the fact that the use of 16-ft. pipe would necessarily reduce the loss from joint leakage 25 per cent. The exercise of more care in caulking and alignment, and the testing in open trench where practical would also tend to reduce loss from this source. More stringent regulations regarding the making of service connections and proper care in doing the work and examination of frequent intervals thereafter would unquestionably eliminate much of the waste. The same thing, of course, applies to other causes of loss. The writer believes that fully two-thirds of the leakage as determined in this article is entirely unnecessary and might be prevented at a cost which would undoubtedly represent a saving to the city.

Why One Contractor Will Bid Higher the Next Time

"When the mixer starts, Hell breaks loose. The engineers take delight in standing by until we are ready and then in finding something to delay the work while the mixer crew waits." Such is part of a superintendent's report, explaining his bitter disappointment to his contractor employer for placing less than 400 cu. yd. of concrete in two months on a Government contract that could easily be pushed several times as fast. The superintendent further explained that it mattered not how true or how well forms and steel were placed, the work was never done correctly unless it was done the engineer's way. His way always cost more and there was no arguing with him that another method would produce equal results. Surely a remarkable report coming as it did from one of the oldest employees of a firm of contractors noted for fairness and ability to do good work. If the contractors were not well acquainted with their superintendent they would be inclined to think he was partly to blame, but difficulties of this kind have never risen before in the twelve years of his employment, and careful investigation on the job showed that the report was not exaggerated.

A few notations on the form sketch sent in by the superintendent indicate the needless care with which the structure had to be built. Concrete in side walls, only 11 ft. high, could not be poured from the top but had to be deposited in several layers, the upper panels of the forms being left off for that purpose, thus causing much delay. All forms were required to be set within ⅛ in. error and bars within ¼ in. The forms were complicated beyond possibility of description here.

The superintendent wound up his letter resignedly with the characteristic attitude of his company, "We will do the best we can." The contractors state that they instructed the superintendent to get the job done the engineer's way. But they added that this is the reason why work for this particular department of the Government costs so much more than private work. If this firm can again be induced to bid for work in this department, the prices will be considerably higher than those of the present contract. Of course, the occasional isolated case like the above gets more publicity than half a hundred regulation contracts where give-and-take, fair-and-square methods of procedure obtain. While anathemas are heaped on the unreasonable engineer, this is not the end of the story, for irreparable damage is done to the whole profession and to the particular organization with which he is connected. The news of his unreasonableness is sure to spread among contractors, and his attitude will be imputed to the department which he represents.—Engineering Record.

In excavating for the new Pier 2 of the Intercolonial Railway at Halifax, N.S., a number of old pile stumps were found. These stumps were the remains of piles which had been eaten through by limnoria below low-water level. It was found that uncreosoted lumber was eaten from extreme low-water down to the mud level even when that was 30 ft. below. Several creosoted hard pine piles that had been in the water about four years were found to have been attacked to a depth of about ½ in. No signs of the teredo were found; apparently, all of the boring in this harbor is confined to limnoria.

An Earth Dam for Water-Works Reservoir

THE accompanying photograph illustrates the work in progress on an earth dam for the new Ashby Reservoir of the Fitchburg (Mass.) water-works. As the view shows, the dam is being built just below an old dam which held back the water to a depth of about 9 feet to form a storage reservoir for water power uses. The new dam will have a maximum height of about 28 feet, the greater depth of water being 22 feet.

The dam will have a total length of about 1,100 feet, and will consist of an earth embankment containing a thin reinforced concrete curtain wall. The view shows the excavation of the trench for the construction of this wall or cut-off to such depth as may be required.

A knoll divides the dam into two portions of approximately equal length. A cableway crosses the main valley from this knoll to the hillside, and is being used in the excavation of the curtain wall trench. The excavated material is dumped into cars on a short railway running along the side of the knoll, and such as is unsuitable for use in the embankment is used in filling low land below the dam. Later, the cableway will be utilized in transporting concrete from the mixer to the forms in the trench, and for depositing at least a portion of the borrowed earth in the embankment.

Fitchburg waterworks.—Earth dam under construction.

Centrifugal pumps have been set up to care for water in the trench, but thus far there has been no difficulty in handling all the water by the intermittent operation of a pulsometer.

The cableway engine is located in the shed at the foot of the tower in the distance. The boiler on the old dam furnishes steam for the operation of the pulsometer and centrifugal pump, and also for lifting the water required for sprinkling the embankments during construction. The old dam will be removed as far as it is in the way of the new construction.

A considerable amount of the planks and timber required for construction has been sawed, by a portable mill, from the trees cleared from the reservoir site. The smoke shows where the brush and stumps are being burned.

The work is being done for the water department of the city of Fitchburg, from the plans of Messrs. Metcalf & Eddy, Consulting Engineers, of Boston, and under their advisory supervision. It is in the immediate charge of Mr. Ernest E. Lothrop, City Engineer. The E. W. Foley Contracting Company, of New York, are the contractors.

We are indebted to Messrs. Metcalf & Eddy for our information.

In a paper read to the Boston Society of Civil Engineers, Mr. Leonard C. Wason, M. Am. Soc. C. E., gives the practical solution adopted in the case of a somewhat unusual problem. In connection with the construction of a lofty tower it was required that the walls and two floors near the top should be monolithic and perfectly watertight, so as to obviate the penetration of moisture in driving storms. Each floor has an area 28 ft. by 30 ft. and carries a load of 400 tons, the floor being supported on a main girder with secondary beams running from it to the opposite walls. The specification required absolute prevention of all cracks, impermeable concrete and as nearly continuous work as possible. Under ordinary conditions there would be frequent joints between the work done on successive days, and these might have allowed the penetration of water. The problem was solved by adopting somewhat lower working stresses than those customary by designing special moulds for depositing a large amount of concrete at one time, and by continuous work with different shifts of men, combined with very close supervision. The result, as stated by the author, proved satisfactory in every way.

Sand and cement (or dry mortar) cushions are used extensively for wood-block, asphalt-block and recently experimentally for granite-block pavements. Mr. D. Moomaw, Road Engineer of Cuyahoga County, Ohio, is now experimenting with a dry mortar bed for brick pavements. The sand and cement are mixed dry in the proportions 1:3 and spread to a depth that when struck and rolled a 1-in. cushion is formed. A hand roller weighing 250 lbs. is used. The preparation of the sand-cement cushion proceeds ahead of the placing of the brick only so far as the pavement can be completed before shopping work for the day. The bricks are rolled only enough to obtain an even surface, and when the rolling and culling is completed the pavement is sprinkled from a spraying nozzle until sufficient water is applied to insure wetting the cushion to its entire depth. Grouting the joints follows the wetting of the cushion and is completed as far as the blocks are laid. If weather conditions do not permit grouting on the day the bricks are placed, the pavement is covered and protected against rain and wash.

Refuse Incinerator Guarantees Too Strict for Practical Fulfilment

Liberal Interpretation of Specifications Necessary for Acceptance of Plants Under Prevailing Contract Terms—The San Francisco and Atlanta Cases

THE decision of city officials in Atlanta, Ga., and San Francisco, Cal., to reject high-temperature refuse incinerators, because of the failure of the plants to fulfil certain guarantees under test, has brought the character of the specifications into question, says a writer in The Engineering Record. High-temperature refuse incineration is a comparatively recent development in this country. The first plants were built at Westmount and Vancouver in Canada, and at West New Brighton, N. Y., and Seattle, Wash., in the United States—all of which were constructed between the years 1905 and 1908.

These plants were all patterned after English design, and, in fact, were built indirectly through English concerns. A larger plant, with a capacity of 300 tons per day, was completed for the city of Milwaukee in 1910. Since that time, no less than eight of these plants have been built in this country, with capacities ranging from 50 to 250 tons per 24 hours. In this comparatively short time, rapid progress has been made in the design of the plants, particularly as relates to the mechanical handling of the refuse to be burned, and the clinker resulting from the combustion. All of the plants of this type in this country, however, are similar in the general principles of design, construction and operation.

Specific Guarantees Required

The first four plants built were let under lump-sum contracts without special guarantees of operation or steam production, and the bids were compared on the first cost of the plants. The first specifications, typical of those now in general use for high-temperature incinerators, were used at West New Brighton in 1907 and at Milwaukee in 1909. The Milwaukee specifications left the design of the details of the plant to each bidder, protecting the city by requiring guarantees of operation along certain definite lines, very much as the performance of pumping engines is guaranteed.

The specific guarantees required may be summarized as follows: (a) That no nuisance be created during the ordinary operation of the plant; (b) that no odors, obnoxious gases, smoke or dust escape from the chimney; (c) that the temperature of combustion shall not fall below 1,250 deg. Fahr.; (d) that the residuum from the furnaces be thoroughly burned, hard and free from organic matter; (e) that the rate of combustion meet the statement guaranteed in the bid; (f) that the rate of evaporation in the boilers be not less than was stated in the bid, and (g) that the labor cost per ton be not more than was stated in the bid.

These guarantees have since been included in practically all specifications for high-temperature refuse incinerators. Certain modifications of expression have been used for each locality, but the essential features of the guarantees have remained the same. Specifications recently issued at Toronto, however, for a plant to have a capacity of 160 tons per day, include several important modifications, to be mentioned later.

When the fulfilment of contracts and specifications becomes the subject of litigation, weak points, if there be any, are likely to appear. The city officials in Atlanta and San Francisco have refused to accept the incinerators built for their cities, claiming that certain of the guarantees have not been fulfilled. The case at Atlanta is now before the court for its second trial, and testimony has been taken. The San Francisco case has not yet come to trial. It is pertinent to inquire into the relation between the specifications and guarantees, the failure of the plants to pass the tests, and general local conditions affecting the situation.

The plant at San Francisco was tested by the city officials as required by the specifications, for a period of 30 days, from September 4 to October 3, 1914. The results of the tests were reported by the city engineer with the recommendation that the plant be rejected for the reason that it did not fully meet the requirements of the specifications. The guarantees were essentially those quoted above from the Milwaukee specifications. The city engineer held that the plant failed to meet the requirements in the following particulars: (1) That no nuisance be created in its normal operation; (2) that no odors, obnoxious gases, smoke or dust escape from the building or the chimney; (3) that the temperature shall at no time fall below 1,250 deg. Fahr. (this guarantee, however, was fulfilled in that the average temperature was in excess of 1,500 deg. Fahr.); (4) that the residue from the furnaces be thoroughly burned, hard, and free from organic matter. In all other requirements the guarantees in the contractor's bid were fully met.

The grounds on which the city officials at Atlanta refused to accept the plant are very similar to those at San Francisco. It is claimed that nuisances are created during the operation of the plant; that dust, smoke and odors escape from the buildings; and that the residuum from the furnaces is not free from organic matter. It was also claimed by the city officials that the plant could not make steam at the guaranteed rate. This point hinged on whether or not the work done in the feed-water heater could be credited to the plant. The actual rate of evaporation under test fell either above or below the guaranteed rate, depending upon whether or not the evaporation was computed from hot or cold feed-water. The plant was tested on two occasions for periods of about one day each.

In both San Francisco and Atlanta the plants were operated by the contractor during a tuning-up period of about one year prior to their being tested. Defects in design and construction, which appeared during this time, were in each case remedied by the contractor, and it appears that so far as design and construction are concerned the two plants are up to the best work that has been done in this country and abroad.

Guarantees Unworkable

From this brief summary of the development and character of specifications now used for the construction of refuse incinerators, and from the statement made of the reasons for the rejection of plants of this type by two comparatively large cities, several deductions can be made. In the first place, the guarantees relating to the sanitary operation of the plant are so stated that their fulfilment is virtually impossible. It is a matter of great difficulty to handle mixed refuse so that absolutely no nuisance is created, and it is also practically impossible to prevent absolutely the escape of all obnoxious gases, smoke or dust from the chimney or building.

In other tests of incinerator operation under guarantees, engineers have interpreted these requirements somewhat more liberally. Plants which have fulfilled the intent of the guarantees have been accepted by city officials upon the recommendations of their engineers. In some instances, the recommendations have been qualified, as at Milwaukee, where it was stated that "a certain amount of dust and hot gas must be created, and it is, of course, not feasible to confine all of this inside the furnaces and ventilating ducts."

The requirements that the residuum from the furnaces shall be free from organic matter is also difficult to fulfil. In most instances where cities have accepted proposals in which this guarantee is made, there has also been required from the contractor a statement showing the method of computing the heat balance. Such heat balances include among the losses, an item for unburned carbon in the clinker and ash. Obviously this statement, presumably accepted by the city with the proposal, is in conflict with the requirement that the residual material be free from organic matter. It is evident, therefore, that in plants which have been accepted as having fulfilled this guaranty, the interpretation of the test has been liberal.

Toronto Specifications

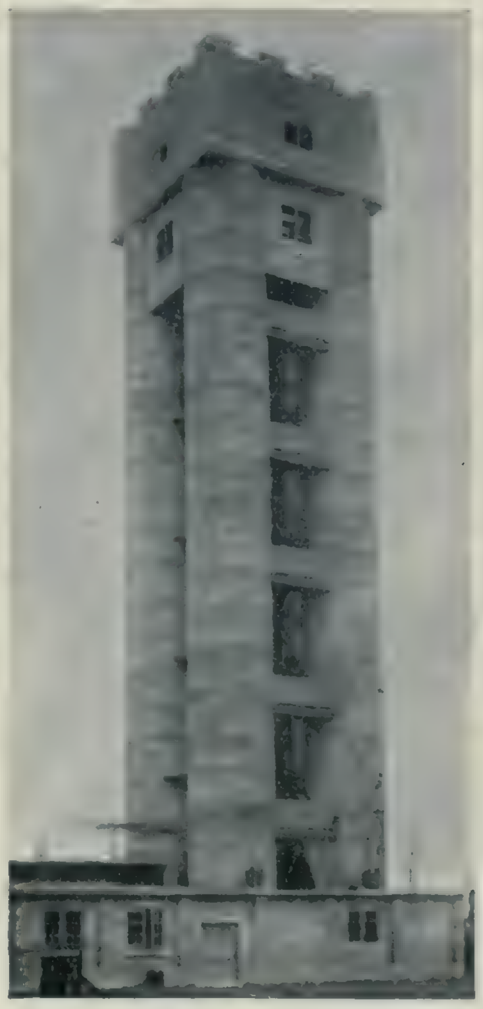
The Toronto specifications on these points include the following guarantees: (1) That no smoke shall at any time escape from the chimney of a degree of darkness or density greater than that determined by density 1 of Ringelmann's smoke chart; (2) that no dust shall be emitted from the top of the chimney; and (3) that the residuum from the furnaces shall not contain more than 1 per cent. of organic matter, exclusive of carbon.

It is quite possible to build plants which will fulfil these guarantees. Contractors who undertook to build plants under the stricter guarantees must have counted upon a liberal interpretation by city officials. It is probable that the definite statements of these guarantees were forced into the specifications by public opinion. The attempt of one side in a garbage controversy to satisfy the opposition may have led to promises incapable of fulfilment.

The bridge upon the Meuse at Bouvignes is a recent example of reinforced concrete work. Lying as it does in the region of the war, it is not unreasonable to suppose that, like other bridges in Belgium, it was exposed to more or less damage. The present bridge has a total length between abutments of 393 ft., made up of a mid-river span 110 ft. long and two end spans, each of about 140 ft. Reinforced concrete on the French Hennebique system is used here. Outside width of the bridge is 13 ft., including wagon way and two footways, and the former is paved with compressed asphalt laid directly on the reinforced concrete bridge-planking. This makes the roadway very elastic, and is found to be an excellent method. Some points about the building of the two piers in the river may be of interest. This work was carried out by means of caissons built of reinforced concrete and further stiffened by webs of the same. The details are from the columns of Ferro-Concrete, which cheerfully informs its readers that this bridge "is one of an interesting series which will be fully described and illustrated under the head of Ferro-Concrete at the Front, when the tide of war has once more been rolled back into Belgium on the advance towards the Rhine."

Reinforced Concrete Acid Towers

A group of reinforced concrete acid towers built for a large paper company at Erie, Pennsylvania, consists of four towers, 10 ft. by 99 ft., set in a square, 15 ft. centre to centre, with a common foundation slab and a housing at the top connecting all four towers. The foundation slab is 32 ft. square by 6 ft. thick, its horizontal reinforcement being engaged by the vertical rods of the tower reinforcement. The shells are 9 in. thick with ½ in. vertical and ⅝ in. rings of steel rods. The lowest tower section has 20 vertical bars in the circumference, but at the top these are reduced to 12 bars. The rings are spaced 5 in. apart in the lower section and 20 in. apart in the top. A floor over the towers carries a housing, 25 ft. 4 in. square by 7 ft. 6 in. high, over which is a water tank, 11 ft. square by 3 ft. high.



Reinforced concrete acid towers at Erie, Pa.

The proposed Maryland Street Bridge, Winnipeg.

New Bridges for Winnipeg

THE accompanying illustration is of the proposed Maryland Street Bridge, one of three bridges which it is proposed to build across the Assiniboine River. The estimated cost of the three structures is $459,355, divided as follows: Maryland Street Bridge, $141,680; Main Street Bridge, $191,276; Arlington Street Bridge, $126,379. These estimates include land damages, the removal of old bridges, and the construction of temporary bridges during the erection of the Main and Maryland Street structures. Mr. Paul Schioler is Bridge Engineer of the City of Winnipeg.

Temperature Changes in Mass Concrete

IN a paper contributed to the American Society of Civil Engineers, Mr. Charles H. Paul and Mr. A. B. Mayhew discuss the results thus far obtained of experiments made to determine the changes of temperature in the concrete of the Arrowrock Dam. Some of these experiments have been in progress for more than a year; the greater part of the results is still affected by the high temperature produced by chemical action while the cement is setting. Therefore this paper should be considered as one of preliminary character. Among the conclusions already reached are the following:—

(1) Large bodies of concrete deposited rapidly during a summer season develop a temperature of from 90 to 95 deg. F., within a period of about thirty days, and maintain nearly that temperature for several months.

(2) In the case of concrete 1 ft. from an exposed face, there is a daily variation in temperature of about 2 deg. F., when the daily variation in the temperature of the air is about 50 deg. F.

(3) In the case of concrete 2 ft. from an exposed face, there is a daily variation of less than 1 deg. when the daily variation in the temperature of the air is about 50 deg. F.

(4) In the case of concrete 3.5 ft. from an exposed face, no daily variation in temperature is apparent when the daily variation in the temperature of the air is about 50 deg. F.

(5) The seasoned variation in the temperature of concrete 3.5 ft. from an exposed face is about 32 deg. F. when the seasoned variation in the mean daily temperature of the air is about 75 deg. F.

(6) The experiments have not yet been carried far enough to show the seasonal variation at other distances from exposed faces, but it is probable that they become very much less as the distance from the face increases.

Oil Makes Concrete Waterproof

WHILE experimenting in an attempt to develop a non-absorbent, resilient and dustless road material, capable of withstanding the severe shearing and ravelling action of automobile traffic, Logan Waller Page, Director of the U. S. Office of Public Roads, discovered the waterproofing qualities of oil mixed concrete. Extensive laboratory and service tests have definitely established the value of this oil-mixed concrete for damp-proof construction, and a new bulletin, No. 230, has been issued by the U. S. Department of Agriculture. This bulletin discusses fully the preparation and use of oil mixed concrete. Briefly summarized, the conclusions to be drawn from them are that the admixture of certain mineral oils in small proportions, not to exceed 10 per cent. of the cement used, does not lessen the tensile strength of mortar; that the decrease in the compressive strength of mortar and concrete is not serious; that concrete mixed with oil takes much longer to set hard, perhaps twice as long, but that the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete.

The use of oil does not make the concrete impervious to heavy water pressure, but it does make it practically non-absorbent under low heads.

The value of oil-mixed concrete is said to be particularly great in the construction of basement floors and walls, watering troughs, cisterns, barns, silos and in all parts of concrete structures that are to be made damp-proof.

The oil should in no case exceed 10 per cent. of the weight of the cement and for the most part 5 per cent. is all that is necessary. Since a bag of cement weighs 94 pounds, 4.7 pounds of oil, or about 2½ quarts, should be added for each bag of cement used in the mixture.

The sand and cement should be first mixed with the proper amount of water into a stiff mortar, to which is added the correct amount of oil and the whole mass again thoroughly mixed until all traces of oil have disappeared. Particular care should be taken to insure that the oil is thoroughly incorporated in the mixture, and the time of mixing should be practically double that when the oil is not used.

The kind of oil is also important, and technical specifications are suggested in the bulletin, in order to prevent the use of certain oils which might tend to impair the strength of the mortar or the concrete.

For practical use the addition of oil will be found particularly useful in the construction of basement floors and walls. Many of these now in existence are continually damp and such a condition may be remedied by the application of an oil-mixed mortar coat to the old surface. A mortar composed of one part of cement and two parts sand, and containing 5 per cent. of oil, should be sufficiently non-absorbent for this purpose.

Watering troughs and cisterns made of oil-mixed concrete should also prove of considerable practical value in the conservation of water. In the construction of barns, where oil-mixed concrete is used, the interior will be noticeably drier than when ordinary concrete is used.

Owing to their durability, cleanliness and resistance to fire, concrete barns are becoming more and more popular, but they suffer from the disadvantage that during a long beating rain the side walls are inclined to absorb much moisture, which, ultimately, penetrates into the interior. The addition of oil to the extent of 5 per cent. of the weight of cement in concrete used in the side walls obviates this objection. Barn floors can also be constructed in the same way with advantage. A damp-proof floor is warmer because of the lack of evaporation from its surface, and it is also more sanitary than an ordinary concrete floor because of its non-absorbent character.

Attention is called, however, to the fact that extreme care in proportioning, mixing, and placing the concrete is absolutely necessary if the addition of any water-proofing agent is to be of any value. The process of oil with concrete has been covered by a public patent so that anyone is at liberty to use it.

Planning Formwork Ahead

Some years ago, writes a prominent contractor, when we simply sent the foreman a set of blueprints of the building and said, "Go ahead and build it," leaving him to work out his own form designs, column forms used to cost, for direct labor, as much as 18c. per sq. ft., and floor forms 12c. Now we spend much time in the office making plans, sometimes as many as 45 sheets of form details for a simple building. These designs may cost 0.2c. per sq. ft. of formwork. But now if the cost for labor for floor forms runs over 4c. per sq. ft. we want to know what is the matter; if it runs over 7c. for a column we usually make a row. We have come to the conclusion that a dollar spent intelligently in the draughting room usually saves ten on the work, and sometimes more.

Saanich municipality, Vancouver Island, is planning for big expenditures on water-works and paving projects. The work in view will call for $825,000, about one-half being set aside for the paving of streets and roadways.

Hydrated Lime and Ordinary Lime

By E. W. Lazell, Ph.D.[*]

EVERYONE is familiar with the fact that when quicklime is treated with water a violent action takes place, the lumps of lime break up, heat is generated, steam is given off and after the action is completed, a paste or putty remains—the ordinary lime putty used for mortar. The fact that quicklime has changed its form from dry lumps to a wet paste and that heat has been generated, prove that a chemical reaction has taken place; or that quicklime has combined chemically with water. It is a scientific fact that when any chemical change or reaction occurs exact amounts of the material are involved. In the chemical change which takes place when lime is quenched with water definite amounts of lime and water are involved; in slaking lime an exact amount of lime unites with an exact quantity of water, forming an exact amount of hydrated lime and it differs from the original quicklime, and if water is present to satisfy the calcium oxide (lime) then a dry powder will remain. This powder is hydrated lime and it differs from the original quicklime and from pulverized lime in its behaviour towards water. When water is added to hydrated lime no heat is generated nor does the material slake, thus indicating that water has no further chemical action on the hydrate.

What is Hydrated Lime?—Hydrated lime of commerce is the dry powder resulting from the treatment of lime with sufficient water to satisfy the chemical requirements of all the calcium oxide.

Necessity for Exact Proportions of Lime and Water.—In the foregoing, emphasis has been laid upon the fact that precise amounts of lime and water react chemically. In other words, 1 lb. of lime requires a certain definite amount of water to form a perfect hydrate. If too little water is used in quenching the lime in the process of manufacture, the lime will be burned in slaking, and free lime, or lime which is not combined with water, will be present in the hydrate, rendering the material unsound. Plaster made from such hydrated lime will later pop and pit, due to the gradual slaking of the free lime by the mortar made from such unsound hydrate generally works tough and non-plastic. The free, uncombined lime when present to any considerable extent, will dry out the mortar, rapidly decreasing its strength and causing it to crumble. Free lime in hydrated lime is a dangerous ingredient and one which will always give trouble.

If too much water is used in the preparation of hydrate the material will be damp and wet, rendering it difficult to handle.

Obsolete Methods of Manufacture.—In the past, three methods were used to produce hydrated lime:

(1) Small pieces of lime were placed in a basket and immersed in water for a few minutes, until slaking began, when they were withdrawn and placed in a heap in order to conserve the heat and prevent the escape of the vapour; the material swelled, cracked and became reduced to a dry powder.

(2) Lumps of lime were placed in a heap and wetted at intervals until the mass was equally moistened throughout. The slaking proceeded as in the first instance.

(3) Small pieces of lime were exposed to the air for a number of months, and the lime absorbed both water and carbon dioxide from the atmosphere, falling to a dry powder. The powder consisted of dry

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[*] Chemical Engineer, Portland, Ore.

sub-carbonate of lime containing about 10 per cent. to 11 per cent. of water.

These three methods of dry-slaking lime were crude, and unless the greatest care was exercised the resulting product contained particles of unslaked lime. The hydrate produced by these methods was generally short and possessed poor sand-carrying capacity; in fact, hydrated lime made by any of the above methods was suitable for use in agriculture only, and such hydrate should not be confounded with hydrated lime manufactured by modern methods.

Modern Methods of Manufacture.—The modern method of manufacturing hydrate depends upon the addition of a definite amount of water to a predetermined amount of lime. By no other method is it possible to produce a hydrate which will contain sufficient combined water to satisfy the demands of the calcium oxide (lime) present. It is of the utmost importance that all the calcium oxide be in combination with water, otherwise the hydrate will be unsound and unsuitable for building uses. That all the lime be satisfied with water will be insisted upon in any specification which may be drawn for hydrated lime to be used in the building trade, and it is vital for each manufacturer to recognize that the formation of hydrated lime involves a chemical change requiring the presence of exact amounts of lime and water. Since the process is chemical, it requires the same careful supervision as any other chemical process—such as the manufacture of Portland cement. The production and use of hydrated lime have been more retarded by the manufacture of only partly hydrated lime than from all other causes. Any method of manufacturing hydrated lime continually to produce a perfect product must be based upon weighing the lime used and measuring the amount of water added.

Advantages of Hydrated Lime from the Standpoint of the Manufacturer.—One of the great difficulties in connection with the manufacture of lime is the perishable quality of the product. Lump lime cannot be stored for any length of time without deteriorations, thus making the operation of the plant dependent upon the season and the whims of the weather. Kilns must be fired up, damped down, or put out, according to the season of the year and the condition of the weather. This unevenness of operation results in a high unit cost. Since hydrated lime can be stored in bins in a manner similar to cement, it is possible to make the operation of the plant more nearly continuous, thereby introducing economies in the manufacture and reducing the cost. The manufacture of hydrate also means a more extended market, as hydrated lime can be used for a number of purposes for which quicklime is not suitable.

Advantages to the Dealer.—Three principal advantages to the dealer are the ease in handling, less deterioration of the product, and the freedom from fire risk. These three facts alone should convince the dealer that it is more economical to handle hydrated lime.

Use of Hydrated Lime.—In general it may be stated that hydrated lime is suitable for any use in the building trade to which lump lime can be put, and it would appear that as soon as the material comes into general use, its advantages will be found to far outweigh any disadvantages. The use of hydrated lime does away with the necessity of slaking lime to a paste, thus saving the space required for the slaking bed as well as the labor of slaking. By the use of hydrate it is possible to proportion the mortar so as to have exact quantities present, since this form of lime comes into the market in convenient packages of known weight. This point is always appreciated by the architect and engineer, as it is a well-known fact when lump lime is used as much sand as possible is added, with the result that the mortar is lean and possesses little strength.

Mortar Made from Hydrate Stronger Than That Made from Slaked Lime.—In June, 1910, the writer presented the results obtained from an extended series of tests on mortars made from both hydrated lime and lump lime to the American Society for Testing Materials. One of the most important conclusions drawn from these investigations was that the mortar produced from hydrated lime was stronger than that produced from the corresponding lump lime slaked to a paste. This conclusion was to be expected, since it is possible to manufacture hydrated lime by mechanical means under good chemical control which is more thoroughly slaked than it is possible to slake lump lime on the job.

Practically all those who have investigated the strength of lime mortars have recommended the use of hydrated lime in place of lump lime. In Bulletin No. 30 of the U. S. Bureau of Standards the following statement is made:—"The proportion of impurities in hydrated lime is generally less than in the lime from which it is made. In building operations hydrated lime may be used for any purpose in place of lump lime, with precisely similar results. The consumer must pay the freight on a large amount of water, but the time and labor required for the slaking are eliminated and there is no danger of spoiling it either by burning or incomplete slaking. For all building purposes hydrated lime is to be preferred to lump lime. By its use the time and labor involved in slaking may be saved and the experience of the laborer is eliminated as a factor in the problem."

If the use of hydrated lime in the building trade is to be increased, this can be brought about only by the manufacturers of hydrate preparing and marketing only such material as is sound and contains no free lime. There is an increasing demand for hydrate for use in concrete to render the material more plastic and dense. Hydrated lime can be advantageously used in all cement plaster and stucco to make them work smoothly and give a more pleasing color. In all these uses the soundness of the hydrate is the paramount requirement. No one would think of using unsound cement—why, then, should they expect to use unsound hydrate?

The market for hydrated lime is present, and a concerted action on the part of the lime manufacturers to exercise the care necessary to make a thoroughly hydrated lime will result in a more extended use of the material. It is to be hoped that the manufacturers will direct their energies along this line.—Concrete-Cement Age.

The American Society of Civil Engineers have appointed a special committee to codify present practice on the bearing power of soils for foundations and to report upon the physical characteristics of soils in their relation to engineering structures. The committee have prepared three sets of questions asking (1) for results of tests for bearing value of soils; (2) for data as to the bearing value of soils from existing structures; and (3) for local practice as to the bearing value of soils. Answers to any or all of these series of questions are requested from every one having information concerning them.

The Five Orders of Architects

THE following extracts from a musty volume of the 18th century on the duty of the architect, contained in a recent issue of the London Builder, may appeal to the humorous side of some of our readers:

"As there be five Orders of Architecture—namely, the Tuscan, Dorick, Ionick, Corinthian, and Composite, of which all elegant structures be composed or ornamented—so likewise are there five orders or different kinds of architects, each differing from one another, yet all of them are paid or recompensed in like manner by those requiring their services, and the payment is at the rate of £5 per centum on the moneys expended on the erection of the structure devised by the architects.

"And the **First Order of Architects** is that called the Art Architect, who hath much conceit of his calling. He is oft-times dressed in curious fashion in a coat of velvet, and weareth a beauteous tie and a soft hat. His hair falleth over his forehead in curls and quaintly toucheth his collar. Those who employ him fear him, for he who crosseth his fancy he treateth as a felon or else sheddeth salt and bitter tears. His devices for buildings are oft-times exceeding quaint, and at times inconvenient to those who occupy the dwellings he deviseth. Yet is there thought and meaning abundant in all. He deviseth hearts upon doors and chimney-corners, the fires whereof oft-times smoke, yet their appearance is exceeding quaint and primitive. He quarrelleth with the decrees of the local surveyor, as no such an one existed in the time of the Heptarchy. The latches upon his doors one pulleth with a bootlace, and he thinketh of a pigeon-cot and sundial even in the forecourt of a City office. Thy garden space he filleth with clipped yews and lily ponds, and the pegs for thy washing will he design to teach thy maidservant culture.

"Now, the **Second Order of Architects** is that called Practical, and none would know them from stockbrokers by outward seeming. Unlike the architect of the first order, he of the second order buyeth thy chimney-pieces ready-made and knoweth where thy wife wantyth the draining-board of a sink that her maid may place unwashed crockery thereon without hurt. He falleth in readily with thy wishes, saying this is the whole duty of one of his calling. Yet mayhap thou wilt discover the dwellings he deviseth are exceedingly commonplace and like to those raised by the builder without aid, and thou mayest find him more practical in word than in deed.

"The **Third Order of Architects** is the Competitive Architect, and the manner of his working is altogether different from that of the architect of the first and second order. For whereas these are chiefly concerned with the devising of dwellings, the Competitive Architect's brain is even like unto a seething caldron of mighty thoughts. He draweth out schemes for public buildings which are not straightway given unto him, but only if they have been matched against many others and adjudged better than they are. He burneth the mid-night lamp, and sweat rolls down his forehead even on to the paper whereon he worketh. He is balanced in the scales of hope and of fear, and his excitements are many. For, as Holy Writ hath it, many are called but few chosen, and oft-times the architect of the third order cannot discharge the reckoning of his washerwoman. Yet fixeth he his eyes on the stars and his mind is filled with great thought. When he succeeds he oft-times watcheth princes lay the cornerstone of his buildings while many applaud, and his name waxeth great in the land.

"Now, the **Fourth Order of Architects** men call Speculative and very different is their method. For the first three orders have no thought of the wherewithal from which payment must come, but wait in their chambers for the knock of the client. But those of the fourth order see a fair piece of land and show those who desire money how by building therein they can make more. Yea, balance sheets are the weapons wherewith they fight, and they will even tell one where money can be had at interest if more can be made by borrowing thereof. As other men, some among them are good and others bad, who lead the unwary into pitfalls and grow fat with the five per-centum on what has been expended. Yet the fourth order has its uses, nor may man condemn them without judgment.

"The **Fifth Order of Architects** is that called Official, and hath this difference from all others. For whereas the four orders we have mentioned live even upon five per centum or starve because it is lacking, the Official order is payed even by salary by public bodies who employ them continuously. So care sitteth not beside them, but neither does the hope of great reward brighten their years. And have they the bitterness spoken of in Holy Writ of serving masters manifold, who are appointed not because of their knowledge of Art, but simply by the pleasure of the ratepayer. And they get them grey hairs and troubles attending many committee meetings, nor are those who serve many gratefully treated. And, as among the other orders, some are cunning and fashion great devices, while others have not the skill of the artist.

"And the aforesaid we have mentioned are the five Orders of Architects who use the five Orders of Architecture that the children of man may have habitations, for, since mankind must increase and multiply, so must they have buildings that their bodies be not destroyed by the rigour of the elements."

FREQUENT inquiries are made for methods of cleaning stone. The use of acids is generally to be deprecated, because they tend to injure the texture of the stone. The following suggestions are given by an English contemporary: Equal parts of muriatic acid and water will remove spots of mortar on brick or stonework, but it is not the right material for cleaning stone that is begrimed from smoke and dirt. To accomplish this, apply to the surface, with a long-handled fibre brush, a strong solution of caustic solution of pearlash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this is not effective enough, scrub the stone with a stiff fibre brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove cleaning material. Protect the hands with rubber gloves.

At a plant being constructed in Illinois, tailings from coal mines are to be substituted for clay in the manufacture of bricks. The process entails the combination of some coarse material, containing silica, with a binder of finely divided particles of silica, alumina, potassium, or sodium, in proper proportions. Bricks already made have withstood a temperature of 2,900 degrees F. and a pressure of 20,000 lbs. to the square inch, it is claimed.

Personal Mention

Mr. E. G. M. Cape, the Engineers' Club, and the Garth Company have each given a machine gun for the 60th Battalion which has just been raised in Montreal.

Mr. J. F. McNamara has succeeded Mr. W. E. Oakley as General Manager of the Bayonne Castings Company, Bayonne, N. J. The President of this firm, Mr. R. C. Stanley, advised us that the Company has been completely reorganized and that such changes have been made throughout the foundry and the office as will insure prompt and satisfactory services.

Mr. Ralph T. Coe, Manager of the Canadian Sirocco Company, Limited, Windsor, since the organization of the company, has resigned to enter the engineering service and sales field in New York State. Mr. Coe has been appointed District Manager for Warren, Webster & Company, and the American Blower Company, and will have offices at 519 Insurance Building, Rochester, and 19 Live Stock Exchange Building, Buffalo.

Mr. G. R. G. Conway.

Mr. G. R. G. Conway, M. Can. Soc. C. E., has resigned as Chief Engineer of the British Columbia Electric Railway Company, Limited, and has been appointed Consulting Engineer to the company. In addition he intends to take up private practice in Toronto. Previous to his association with the British Columbia Railway, Mr. Conway was Consulting Engineer in connection with the construction of the Coquitlam dam for the Vancouver Power Company, and prior to his work in British Columbia he represented Mackenzie, Mann & Company, as Chief Engineer for the Monterey Railway, Light & Power Company and the Monterey Water Works & Drainage Company, at Monterey, Mex. Mr. Conway was educated at Hartley University College, Southampton, England. On leaving college he became assistant to the late Mr. James Mansergh, a former President of the Institution of Civil Engineers, and later Resident Engineer of the City of Aberdeen. Mr. Conway expects to open his Toronto office at the end of July.

Mr. M. J. Butler, C.M.G., executive head of Armstrong, Whitworth of Canada, Limited, and ex-president of the Canadian Society of Civil Engineers, is to be appointed consulting engineer of the Montreal city water-works, which will include the construction of the filtration plant and the widening of the aqueduct. This work involves an enormous expenditure. Five million dollars has already been spent, and the Controllers are asking for authority to spend an additional $3,500,000, made up as follows: $1,500,000 for installing the hydraulic power plant, pumps, etc.; $675,000 for strengthening the retaining walls; $560,000 for bridges over the open viaduct; $475,000 for additional improvements at the entrance of the open viaduct; $100,000 for water-gates; $87,864 for the supervision of the works; $35,000 for fences; $25,000 for ditches; $15,000 for culverts; and $25,000 for a wall at Bond Street.

Under the re-organization of the firm of M. Beatty & Sons, Limited, of Welland, Ont., which has just come into effect, Mr. H. L. Beatty becomes President and Mr. A. L. Beatty Vice-President and General Manager. Mr. Harris T. Dunbar, of Buffalo, becomes a member of the Board of Directors. Messrs. V. R. Browning, B. F. Miles and R. A. Greene sever their connection with the company.

Mainly Constructional

East and West—From Coast to Coast

The Cedars Rapids Manufacturing and Power Company have under consideration adding 10,000 to 30,000 horse power to the capacity of the plant. Provision was made for this in the original plans.

The Aetna Explosives Company, who are building a plant in Montreal, have placed an order with the Turbine Equipment Company for two 750 k.w. non-condensing steam turbine-driven alternators.

A recent contract award of interest is that for an incinerator for the town of Transcona, Man. The successful tenderers were The Ideal Incinerator Company, Toronto, at a figure in the neighborhood of $20,000.

In future the Montreal Council will purchase rough granite stones and have them dressed in the city, the Stonecutters' Union having offered to cut straight curbs at 27 cents a foot and the corner stones at 30 cents a foot.

The Ric-wiL Underground Pipe Covering Company, with head office at Cleveland, O., has received an Ontario license authorizing it to carry on its business of manufacturing pipes, fittings and pipe coverings in that province. The license limits the amount of capital to be used in the province to $40,000.

Messrs. Viau & Venne, architects, Montreal, have awarded additional contracts in connection with the school and residence, which are to be erected on Fifteenth Ave., Lachine, Que., at a cost of $150,000. The building is to be 60 ft. by 243 ft. in dimensions, four storeys high, of concrete and brick construction.

Mr. Paul A. Schoellkopf, of the Hydraulic Power Company, is interesting himself in a scheme of permanent illumination of the Falls. Mr. Schoellkopf has just returned from the San Francisco Fair and states that he will use his influence to have the searchlight plant now used at the Fair removed to Niagara Falls, as soon as the Western exhibition is closed.

Excavation has already begun for the construction of the new plant of the Canadian Car and Foundry Company, at Kingsland, New Jersey. Work is to be pushed, and it is understood a building 1,350 by 327 ft. will be erected. The plant will be used for assembling and loading work in the fulfilment of the contract for shells which the company has with the Russian Government.

The new orphanage which is being erected on Decary Boulevard, Montreal, at a cost of $175,000, has reached the roofing stage. Good progress has been made on the building throughout. The architect is Mr. A. Piche, of Montreal, and the contractors are The Deakin Construction Company, of Montreal. The new building is of brick construction, with stone trimmings.

The foundation work has been started for the new theatre which the St. Denis Theatre Company, Limited, are going to erect on St. Denis Street, Montreal, at a cost of $300,000. The architects are Barott, Blackader & Webster, of Montreal, and the general contractors Messrs. Norcross Bros. Company, Limited, Montreal. The building is to be 205 feet by 110 feet in dimensions, of brick and steel construction.

Work is progressing rapidly on the two large blocks which are being erected on Portage Avenue, at Winnipeg. Day and night shifts are being worked in order that the buildings may be finished by next fall. Messrs. the Sutherland Construction Company have the contract for the Curry Block, while Messrs. Carter-Halls-Aldinger Limited, have the contract for the Paris Building, both of which will cost in the neighborhood of $250,000.

One of the largest industrial mergers of recent years in the West was recently consummated with the merging of the Western Foundry and Metal Company, Limited, and the Canadian Equipment and Supply Company, Limited, both of Calgary, and the International Supply Company, Limited, of Medicine Hat, into the Canadian Western Foundry and Supply Company, Limited, capitalized at $1,000,000, with head offices in Calgary.

In addition to building a transmission line to Quebec, made possible through the control of the Dorchester Electric Company, The Shawinigan Water and Power Company propose to enlarge the capacities of The Northern Aluminium Company and The Canada Carbide Company, with which the Shawinigan company is associated. The Aluminium company will install a plant for the making of rods, which are now made in the United States from the raw material manufactured and shipped by the company.

Operations have been commenced on the construction of a rural telephone system covering the district south of the city of Prince Albert. It is intended that ultimately this system shall cover a district of about two hundred square miles. The operations are being carried out by the South Prince Albert Rural Telephone Company, which was originally operating in this district. The contract for the work has been let to the North Saskatchewan Telephone Development and Construction Company. The line is purely a farmer's telephone system, and among the towns it will touch will be included Davis, Clouston, MacDowall and probably St. Louis.

Objection to the latest plans for constructing underground conduits, designed by the Montreal Electrical Commission, has been taken by some of the companies interested. Hitherto the cables for the police and fire alarm signals and for the light and power companies have been placed in the same conduits, but it is now declared that trouble is likely to result from this system, and it is asked that separate conduits be constructed. This will increase the cost, and the chairman of the Quebec Public Utilities Commission has agreed to adjourn consideration of the plans with a view to having the power companies confer with the members of the Electrical Commission.

An important by-law was introduced as the last meeting of the Winnipeg City Council. This by-law was in respect to the height of buildings and the approval of plans showing encroachments on public thoroughfares. It provides that no buildings shall be of greater height than one and three-quarters the width of the street on which it is to front, and no building shall in any case exceed 198 feet in height. Spires or towers may be erected above buildings, but they must not exceed three-fifths of the height of the building nor must they exceed 300 feet in any case. Final consideration of the proposed by-law will be given at the next meeting of the council.

The Grand Trunk Pacific drydock at Prince Rupert, B. C, (described in detail in a recent issue of the Contract Record). will be electrically-equipped. The power house, 104 x 148 feet, constructed of steel and concrete, contains two 1,000 k.w. turbine generators and a steam-driven air compressor of 1,500 cubic feet capacity. There are also six 400 h.p. water tube boilers supplied with automatic stokers of the chain grate type. A system of underground electrical conduits has been installed throughout the shipyard. On the dock three air compressors of 500 cubic feet each and twelve 24-in. centrifugal pumps are electrically driven. Each shop and the power house are equipped with a 15-ton electrical overhead crane.

One of the Canadian concerns which has benefited materially from war orders is Sheldon's Limited, of Galt, Ont., which owns and operates one of the finest grey iron foundries in the Dominion. Originally producers of heating, ventilating and drying plants, the company was one of the first to turn its attention to shell making, and owing to its aggressive management was among the first to secure orders from the British Government in connection with war supplies, and they are now working on very satisfactory contracts. According to a recent financial report, the net earnings of the company for the last four years have averaged about three and a half times the bond interest. Net earnings for the current year are expected to be more than double those of the previous four years.

Suit has been entered in the Supreme Court by Messrs. Palmer Bros. & Henning, contractors, against the Northern Construction Company, Limited, Messrs. Mackenzie & Mann, the Cowan Construction Company, Limited, the Canadian Northern Pacific Railway Company, the National Trust Company and the British Empire Trust Company, in which the plaintiffs claim the sum of $393,197, the amount they allege is due them as balance for work done in building a portion of the Canadian Northern Pacific Railroad. The total contracts secured by Palmer Bros. and Henning, as set out in the pleadings, amount to $2,228,719, of which all but $393,197 has been paid. The claim for constructing the line from Mile 40 to Mile 74.6 comes to $743,714. That for the line from Mile 27 west of Yellowhead Pass to Mile 35 is $463,714, which includes $76,750 for 1,228 feet of tunnel. The cost of the line from Mile 405 to Mile 424.50 is given at $1,008,276.

The proposed new water-works scheme at Victoria Park, as outlined by Works Commissioner Harris and recommended to the Toronto Board of Control, will cost about $6,000,000, and take four years to build. Some time ago the citizens passed favorably upon a by-law for water-works extensions, amounting to $6,667,000. Of this amount about one and a half millions has been sold, and the money, with the exception of perhaps $100,000, has been used up. The duplicate water-works scheme involves the laying of large mains in North Toronto, as well, for which debentures will shortly be issued. The pumping capacity of the city now is about 100,000,000 gallons a day, and the consumption from 50,000,000 to 60,000,000 gallons daily, but the Works Commissioner, Mr. Harris, points out that in four years this will be greatly increased. The new plant will have a daily pumping capacity of 65,000,000 gallons, and that will bring the total pumping capacity of the city up to 165,000,000 gallons daily.

The present status of the harbor development work at Toronto recalls the fact that the sum of $2,000,000 is being spent this year on the city's water-front from the Don to the Humber. Last year the sum of $1,400,000 was spent. The total cost of the undertaking is $24,000,000. The contracts awarded to date represent the expenditure of $11,000,-

000. The minimum amount to be filled in is 22,000,000 cubic yards and the maximum 32,000,000 cubic yards. The expenditure up to the present time represents $1,100,000 for work under water and $300,000 for work above water. One-fifth of the Ashbridge's Bay work has been filled in, while the Don diversion channel has been completed. The ships' channel is to be completed by the fall. Of the expenditure of $2,000,000 the sum of $1,750,000 goes into the work at the foot of Cherry Street and $250,000 at Sunnyside. The Chief Engineer of the Harbor Commission, Mr. E. L. Cousins, who is the author of the plans of this great undertaking, is now working for the Government on the City's transportation problem.

Large Oil Tanks at Montreal

On an ideal location, on the Tarte Pier of the Montreal Harbour Commissioners, the Asphalt and Supply Company, Limited, Board of Trade Building, Montreal, have erected two immense oil tanks for the purpose of storing oil used for road purposes. Each tank has a diameter of 95 feet by 30 feet, with a capacity of 37,500 barrels, or a total of 15,000 tons. In addition there is a barrelling tank of 1,000 barrels capacity, fed from the main tanks by means of underground pipes, and a fuel oil tank of 1,000 gallons capacity, which draws its supply from the barrelling tank. The fuel oil is utilized in a fuel oil boiler which generates steam for heating the oil prior to its being barrelled. The oil from the main tanks is forced into the barrelling tank by means of a pump. It is intended to add the necessary equipment for refining the oil into asphalt.

The oil is brought to Canada in oil tank steamers, one of which, the San Urbano, recently arrived in the port. This vessel discharged its cargo of 10,000 tons in ten hours. She is an oil-driven vessel, and is part of a fleet owned by the Eagle Oil Transport Company, of London, one of the many enterprises headed by Lord Cowdray. The oil is pumped from the oil-fields, situated eighty miles from Tuxpam, Mexico, to the shore, where it is stored in tanks ready to be pumped into the vessels.

The Asphalt and Supply Company's tanks are situated very near the harbour, and are filled direct from the steamers by means of heavy armoured hose, which is connected to the tanks of the steamer. The pumps of the latter are then set to work, the hose being shifted to the various tanks of the steamer as required.

From M. Beatty & Sons, Limited, Welland, Ont., we have received a copy of an interesting, informative booklet issued in conjunction with the firm's general catalogue No. 21, which contains illustrations and condensed descriptions of Beatty hoists and handling, dredging, and excavating equipment. The firm's products are too well known to require special commendation at our hands. Only a small part of the various equipment is shown, the purpose of the book being to give the contractor concise information calculated to be suggestive to him. The firm's general catalogue, which will be sent on request, gives a detailed description of Beatty hoists, with tables showing sizes, capacities, and weights.

The Republic of Cuba has established a permanent exhibition to which foreign countries have been invited to contribute. Articles taking up large space are excluded. In addition to the products of various countries, arrangements have been made for placing on show lists of trade marks and patent agents, steamship lines, prices, books and pamphlets on commercial and industrial matters, and so forth.

The General Car and Machinery Works, Limited, of Montmagny, P. Q., makers of road machinery, have opened an office at 317 St. James Street, Montreal, under the managership of Mr. J. H. Langis.

In all buildings where numbers of machines are working simultaneously, reinforced concrete offers manifest advantages, because its exceptional rigidity and solidity enable the construction to absorb vibration in a most effective manner. Apart from any question of comfort to workpeople, and of freedom from damage to the structure itself as a result of vibration, the machinery runs better and lasts longer than that in a building subject to vibration. It is stated by Mr. Leonard C. Wason, of Boston, that cotton manufacturers in the United States have found that looms can be run fifteen per cent. faster on concrete floors than on wooden floors subject to vibration; and that a considerable saving of power can be effected in consequence of the rigidity of the construction.

In a paper read to the Royal Institute of British Architects, Mr. Segar Owen says that the ideal factory for reinforced concrete is one made up of units of space and loads as regards floor area and machinery, each floor being set out without much possibility of change. Fire-resisting, temperate, vermin-proof, these buildings form excellent stores, and where carriage of large and heavy girders to the works site is a big item of expenditure a considerable saving can be made by this form of construction.

Storage tanks of the Asphalt and Supply Company, Limited, Tarte Pier, Montreal.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Belleville, Ont.
The laying of pavement on Pinnacle Street, George Street and Victoria Avenue is being considered by the City Council. Clerk, J. Wilfred Holmes.

Collingwood, Ont.
The Town Council are about to issue debentures to the amount of $15,000 for improvements to the Water Works. Clerk, J. H. Duncan.

Cornwall, Ont.
The Town Council contemplate laying granolithic sidewalks on Ninth and First Streets. Engineer, W. H. Magwood.

Guelph, Ont.
The City Council contemplate laying macadam pavement and concrete sidewalks on several streets. Clerk, T. J. Moore.

Work will commence at once on laying 5,500 feet of conduit pipe under the supervision of the Water Commissioners.

Halifax, N. S.
City Engineer F. W. W. Doane has recommended the laying of concrete sidewalks on Morris Street and Victoria Road.

Hull, Que.
The City Council are receiving quotations on a quantity of hydrants, nozzles and valves. Clerk, H. Boulay.

Leamington, Ont.
Plans are being prepared for reinfroced concrete pavement to be laid on Erie Street, and tenders will be called shortly. Engineer, J. J. Newman, Ouellette Avenue, Windsor. Approximate quantity, 7,600 square yards.

Lennoxville, Que.
A by-law has been passed authorizing the purchase of the waterworks, and the expenditure of $14,000 on repairs and extensions. Clerk, W. W. Baker.

London, Ont.
The City Council are about to call for tenders on the construction of a trunk sewer on Waterloo Street. Engineer, H. A. Brazier.

Simcoe, Ont.
The Town Council have referred to the Board of Works a proposal for laying concrete pavement on Colborne St. Clerk, W. C. McCall.

St. Catherines, Ont.
The City Council are considering the laying of pavement on a number of streets. Engineer, W. P. Near.

St. John, N. B.
The City Council are about to lay a quantity of watermain by day labor under supervision of the Engineer, W. Murdock. Commissioner Wigmore is receiving prices on waterpipe, from 4-inch to 24-inch diameter.

Stratford, Ont.
The City Council are considering the construction of sewers on Front, Mile and High Streets and Railway Avenue. Engineer, A. B. Manson.

Welland, Ont.
The Town Council have decided to lay a sewer on Seeley Street. Engineer, D. J. Black.

CONTRACTS AWARDED

Bathurst, N. B.
The City Council have let the following contracts for the construction of waterworks and sewerage systems:—dam, power house, water and sewage installation, A. R. C. Clarke & Son, Water Street, St. John, at $110,788; standpipe, Chicago Bridge & Iron Works, Washington Heights Station, Chicago, at $13,860.

Fort Erie, Ont.
The Municipal Council have let a contract for the construction of a mile of macadam and about 1,000 feet of concrete roadway to W. H. Johnston, Fort Erie. Approximate cost, $10,000.

Guelph, Ont.
The City Council have let the contract for the construction of a reservoir to Hollingsworth & Brennan, 15 South Street, Hamilton, at $8,618. Reinforcing metal, valves and pipes will be supplied by the City.

London, Ont.
The City Council have let the following contracts for sewer construction:—The Fielder Construction Company, 190 Tecumseth Street, approximately $2,500; Webster Construction Company, Bank of Toronto Chambers, $1,200; J. McMurphy, $900.

Melancthon Township, Ont.
The Township Council have let a contract for drain work to F. Calligan, Dundalk, Ont., at $3,500.

Morris Township, Ont.
The Township Council have let the contract for the construction of the Bosman Drain to Felix Curtin, care of John Brooks, Bluevale. A quantity of clay tile will be purchased by the contractor.

Moulton Township, Ont.
The contract for drain work has been awarded by the Township Council to J. Ewing and J. Waddell, Dunnville, Ont.

New Glasgow, N. S.
A contract for laying concrete sidewalks for the City Council has been let to J. Johnson, at 13c. per foot.

Ottawa, Ont.
The City Council have let the contract for laying asphalt pavement on Anglesea Square S. to the Ottawa Construction Company, Central Chambers. Estimated cost, $5,000.

Toronto, Ont.
The following contracts for sewer construction have been awarded by the Board of Control:—West Toronto Sewer, Jennings & Ross, 79 Spadina Avenue, at $32,000; storm overflow sewer, Grant Contracting Company, 50 Front Street E.; Edna Avenue, Commissioner of Works, City Hall; Cloverdale Avenue, Tortorelli & Company, 80 Woodycrest Avenue.

A contract for laying a quantity of asphalt paving has been let by the Board of Control to the Commissioner of Works, R. C. Harris, City Hall.

Railroads, Bridges and Wharves

Chatham, N. B.
Plans of a dam are being prepared by R. S. & W. S. Lea, New Birks Building, Montreal, for the City Council. Tenders will be called shortly. Estimated cost, $20,000.

Haldimand County, Ont.
The County Council will call for tenders shortly on the construction of a number of concrete bridges.

Kennebec Township, Ont.
Plans have been drawn for a steel bridge to be built over Big Cross Lake by the Provincial Government and Frontenac County. Approximate length, 400 feet. Stone approaches.

Swan River, Man.
A by-law has been passed authorizing a debenture issue of $22,000 for the construction of a number of bridges. Municipal Secretary, Joseph Armstrong.

Toronto, Ont.
The Chairman of the Board of Control will receive tenders until August 3rd on the supply of tie rods and plates and for special track work for the Lansdowne Avenue street railway extension. Commissioner of Works, R. C. Harris, City Hall.

CONTRACTS AWARDED

Dufferin County, Ont.
The County Council have let contracts for the construction of two reinforced concrete bridges to W. D. Ballery, Bellwood P. O., and to John Coutts.

Hebertville, Que.
The contract for steel work for the bridge over Lake St. John has been let by the Municipality to the Dominion Bridge Company, Limited, Lachine, Que.

Madawaska County, N. B.
The Department of Public Works, Fredericton, have let the contract for the construction of a concrete embankment and culvert at Four Mile Brook to C. A. Beck, Woodstock, at $4,000.

Nova Scotia Province
The Department of Railways and Canals, Ottawa, have awarded the contract

for the construction of reinforced concrete culverts to G. W. Jewett, Sheffield, N. S., at $52,000.

Quebec Province
The general contract for paving the Yule Bridge between the Municipalities of Chambly Canton and Richelieu has been let to G. Pepin, Chambly Basin, Quebec. Approximate cost, $6,200.

Shawinigan Falls, Que.
The Municipal Council have let the general contract for the construction of a bridge over the Shawinigan River to B. J. Trepanier, 24 Niverville Street, Three Rivers. Sub-contract will be let for steel superstructure. The approximate cost of bridge, $15,000.

St. Boniface, Man.
The contract for the erection of Provencher Avenue Bridge has been transferred to the Dominion Bridge Company, Limited, Canada Building, Winnipeg. Scherzer Bascule design, with underneath counterweight. Approximate cost, $264,707.

St. Philemon, Que.
The Municipality have let the subcontract for steel work in connection with the bridge in course of erection to the Phoenix Bridge & Iron Works, Limited, 83 Colborne Street, Montreal.

St. Vincent Township, Ont.
The Township Council have let the contract for the construction of abutments for a bridge on the 8th concession to W. McColeman, Meaford, and the contract for the superstructure to the Hamilton Bridge Company, Bay Street North, Hamilton.

Vancouver, B. C.
The City Council have let the contract for repairs to the Connaught Bridge to W. Greenlees, 407 Cordova Street West at $7,491. Previous contracts cancelled.

Public Buildings, Churches and Schools

Bothwell, Ont.
Tenders on the erection of a Town Hall will be received until August 4th by the Town Clerk, W. H. Bradley. Plans and specifications at offices of the Architect, W. G. Murray, Dominion Savings Building, London, Ont., and of the Mayor, W. B. Bemish. Approximate cost, $8,500.

Brantford, Ont.
The City Council have passed a by-law providing for a $12,000 debenture issue for school purposes. Clerk, H. F. Conant.

Burford, Ont.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 4th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with G. W. Hall, Clerk of Works, Burford, T. A. Hastings, Clerk of Works, Postal Station F., Toronto, and at the Department, Ottawa. Specifications only at office of MacLean Daily Reparts, 25 Charlotte Street, Toronto.

Cardston, Alta.
Tenders on the construction of a twelve-roomed school are being received by M. A. Coombs, Chairman of the School Board. Plans and specifications with the Secretary, J. E. Harris. Estimated cost, $40,000.

Colborne, Ont.
The Town Council have passed a by-law providing for the erection of a fire hall and police cells. Clerk, H. S. Keyes.

Coteau Station, Que.
The Roman Catholic School Board are considering the installation of a heating system in the Academy School. Suggestions, prices and other information with regard to this work are being received by the Secretary, G. E. Andre.

Port Colborne, Ont.
Tenders on the erection of an eight-roomed school will be received until 5 p.m., July 30th, by C. N. Alair, Secretary to the Board of Education, or the Architect, C. M. Borter, 102 Main Street, Niagara Falls.

Prince George, B. C.
J. E. Griffith, Deputy Minister of Publyis Works, Victoria, will receive tenders until noon, August 6th, for the construction of a two-roomed school. Plans and specifications at office of T. W. Herne, Government Agent, Prince George, and at the Department, Victoria.

Quebec, Que.
Plans for a College estimated to cost $30,000, are being prepared for the School Commissioners of Quebec by Tanguay & Lebon, 20 A'Oiguillon St. Tenders will be called shortly. Stone, brick and steel construction, concrete and stone foundation, metal roofing.

St. John, N. B.
Plans of a school are being prepared for the Separate School Board by C. W. West, Clarendon Street.

St. Johns, Que.
The general contract for alterations and additions to the academy has been let by the School Commissioners to Charles H. Mailhiot, Iberville, Que. Stone and brick construction.

Toronto, Ont.
Work has been started on the erection of a dispensary at the Church of England Deaconess Home, Gerrard and Pembroke Streets. The contract for masonry has been let to E. H. Thomas, 75 Hilton Avenue, and for carpentry to R. G. Kirby, 539 Yonge Street. Brick construction, shingle, felt and gravel roofing. Approximate cost, $5,000.

Transcona, Man.
A by-law for the construction of a school has been defeated and the matter now stands in abeyance.

Windsor, Ont.
The congregation of the Baptist Coloured Church will be in the market shortly for electrical fixtures. Pastor, Rev. Charles Wills.

Winnipeg, Man.
Tenders for the supply of about 800 school desks will be received until August 5th by the Public School Board. Specifications at office of the Commissioner of Supplies.

CONTRACTS AWARDED

Barrie, Ont.
The contract for the erection of a public library on Collier Street has been let by the Town Council to the Ball Planing Mill, 74 Bayfield Street. Approximate cost, $15,000. Cut stone, terra cotta and brick construction.

Brantford, Ont.
The Board of Education have let the contract for heating and ventilation at the Central School to the general contractors, R. H. Ballantyne, 3-7 King St., at $8,000.

Greenfield Park, Que.
The general contract for the erection of a school for the Protestant School Board has been let to Murray & Dempsie, Greenfield Park Avenue.

Lachine, Que.
In connection with the school and residence to be erected on Fifteenth Avenue for the Catholic School Commissioners, the contract for excavation, brick and stone work has been let to F. C. Brunet, 13 Piche Street, and for roofing, heating, plumbing and electrical work to J. O. Desforges, 443 St. Joseph Street. Approximate cost of work, $150,000.

London, Ont.
The Board of Education have let the following contract in connection with the school on Riverview Street:—carpentry, R. Willis, 5 George Street; heating and plumbing, Noble & Rich, Queen Street; painting, Galley & Son, Dundas Street; plastering, John Fern; galvanized iron work, Steveley & Son, Richmond Street.

Lundar, Man.
Work has been commenced on the erection of a school, estimated to cost $10,000. The carpentry, steel, roofing, plastering and painting contracts have been let to Johnson & Sykes, and the heating contract to MacDonald Bros., 276 Burrows Avenue, Winnipeg.

Marmora, Ont.
The general contract for the erection of a public school has been let to David Simmons, Marmora, and work has been commenced. Approximate cost, $10,000.

Montreal, Que.
The general contract for the erection of a school on Fairmont Avenue E. for the Commissioners of St. Viateur, 62 St. Joseph Boulevard, has been let to A. & D. Boileau, 1485a St. Andre Street. Approximate cost, $5,000.

The contract for marble work at the orphanage in course of erection on Decary Boulevard has been let to the Mariotti Marble Company, Provincial Lane, Montreal.

The contract for alterations to the Protestant House of Refuge on Dorchester Street West has been awarded to W. M. Irving, 26a Stanley Street. Estimated cost, $15,000. Work consists principally of interior decoration and renovation.

Outlook, Sask.
The general contract for the erection of a college for the Norwegian Lutheran College Association has been awarded to Poole & Emery, Limited, Smith Street and Twelfth Avenue, Regina, and the plumbing contract to the Regina Plumbing & Heating Company, Limited, Engineers Building, Regina.

Port Arthur, Ont.
The contract for plastering at the addition to St. Joseph Hospital on Algoma Street has been let to M. G. Britton, 4 Meek Street.

A church is being built at Dufferin and Banning Streets for the Italian congregation by I. L. McRae, 488 Red River Road. The work has been stopped temporarily on account of lack of funds.

Sarnia, Ont.
The Sarnia Golf Club have let the contract for the erection of a club house on Christina Street N. to A. McColman, 120 Nutton Street. Contractor will do carpentry, roofing, plastering and painting. Approximate cost, $10,000.

Springhill, N. S.
The general contract for the hall which is being erected for the Knights of Pythias has been awarded to the Springhill Manufacturing Company, the masonry and plastering contract to Fage & Lusby, the plumbing and heating contract to J. C. Weatherly, Springhill, the contract for painting to E. A. Potter & Son, Church Street, and for electric wiring to the Edison Electric Light Company, Main Street.

The Pas, Man.
The general contract for the construction of a school for the School Board has been awarded to Pigott & Healey, Battleford, Sask., and the contract for plumbing and heating to A. T. Englebretson, The Pas. Estimated cost, $43,000.

Toronto, Ont.
The contract for brick and masonry work at the school in course of erection on Baby Point Road has been let to Albert Webb, 13 Shirley Street, Toronto, at $7,900 and for carpentry to T. P. Wright, Baby Point Crescent, West Toronto, at $5,435.

Work has been resumed on the erection of the First Church of Christian Science at Lowther Avenue and St. George Street. The cut stone contract hace been awarded to Nicholson, Curtis & Vick, 1117 Yonge Street.

In connection with the addition to St. John's Church, Kingston Road and Woodbine Avenue, the contract for tinsmithing has been let to F. Toseland, 304 Kingston Road, and for plumbing to Stratton & Cook, 314 Lee Avenue.

Truro, N. S.
The Town Council have let the general contract for the erection of a central fire station to W. K. McDonald, Bible Hill, at $8,495, and the heating and plumbing contract to W. J. Christie, Prince Street.

Westboro, Ont.
The contract for roofing at the school in course of erection on Euclid Street has been let to W. G. Adamson, 126 Sparks Street, Ottawa, the plastering contract to Murphy & Morrow, 139 Waverley Street, Ottawa, the contract for heating to J. E. Sheppard, 261 Albert Street, Ottawa, and for electrical work to J. E. Lewis, Westboro.

Winnipeg, Man.
The contract for the erection of an addition to the Polson Avenue School has been let by the School Board to Worswick Bros., 123 Hart Avenue, Elmwood, at $39,974.

The contract for the completion of the First Church of Christ on River Avenue has been let to the Fort Garry Construction Company, Limited, Ross and Arlington Streets, at $38,285.

Business Buildings and Industrial Plants

Ayer's Cliff, Que.
A. G. Gough is building a general store. Architect, Charles Robinson, Ayer's Cliff.

Barrie, Ont.
The erection of a store at an estimated cost of $8,000 is contemplated by H. D. Minnikin, 227 Elizabeth Street.

Hamilton, Ont.
George Webb, 136 Stinson Street, has commenced the erection of a store and apartments at 22 Wentworth Street, estimated to cost $5,000. Tenders on the smaller trades are now being received. Brick construction.

Plans have been drawn for a store and residence to be built on King Street E. by George E. Mills, King Street. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $4,000.

London, Ont.
In connection with the stores being built at 346 Dundas Street for F. B. Fetterley and M. Aylesworth, the following contracts have been let:—carpentry, S. Willis, 765 Talbot Street; plumbing, Noble & Rich, Queens Avenue; heating and galvanized iron work, Stevely & Son, Richmond Street; plastering, John Senn, William Street; painting and glazing, W. Clark.

Montreal, Que.
Work will start shortly on the erection of a shop and storeroom at Baldwin Park for the City Council. The City will buy material and work will be done by day labor. Brick superstructure, fireproof construction, concrete foundation and floors. Approximate cost, $18,500.

Tenders will be received until August 5th for the erection of a picture theatre on Park Avenue for the Independent Amusement Company, Limited. Plans and specifications with the Architect, D. J. Crighton, Jacobs Building, St. Catherine Street. Estimated cost, $100,000.

Ottawa, Ont.
The painting at the theatre erected on Queen Street for B. Stapleton will be done by day labor. Contract for seating not let.

Quebec, Que.
G. J. Belanger, 1 Second Street, Limoilou, has commenced the erection of a store and residence, estimated to cost $6,000. Work by day labor. Sub-contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

Sydney, N. S.
Tenders will be called shortly on the erection of a store for Wrights Limited, 234 Charlotte Street. Architect, F. W. Spencer. Brick and reinforced concrete construction, concrete foundation, felt and gravel roofing.

Thorold, Ont.
Plans are in course of preparation for alterations to the Grand Trunk Railway Station. Tenders will probably be called for shortly. Superintendent, J. H. Gordon, Hamilton.

Toronto, Ont.
Work has been started on the erection of an addition to the factory of the Canada Metal Company, Fraser Avenue. The contract for masonry has been let to Thomson Bros., Rusholme Road, and for carpentry to R. G. Kirby, 539 Yonge Street. Approximate cost, $15,000.

Plans have been completed for stables to be erected at Ramsden Park for the Board of Control. Approximate cost, $36,000. Commissioner of Works, R. C. Harris, City Hall.

Plans have been drawn for two stores and apartments to be erected at 1259 St. Clair Avenue W. by M. Helfaud, 1378 St. Clair Avenue W. Brick construction, felt and gravel roofing. Estimated cost, $4,000.

George Edwards, 18 Victoria Street, has had plans drawn for a store and workroom to be built at 315 College Street, at an approximate cost of $3,500. Brick construction, felt and gravel roofing.

Winnipeg, Man.
In connection with the store and office building in course of erection on Portage Avenue for D. S. Curry, the contract for installation of elevators will be let by the Architects, J. D. Atchison & Company, 913 Boyd Building.

Zurich, Ont.
William Johnston is constructing cement foundations and making other improvements to his farm buildings.

CONTRACTS AWARDED

Blenheim, Ont.
The general contract for the erection of a hydro electric light station has been awarded to J. J. Cookson & Son. Pressed brick construction.

Cote St. Paul, Que.
In connection with the premises in course of erection at Church and Handley Streets for Molson's Bank, the contract for masonry and carpentry has been let to the general contractors, Anglins Limited, 65 Victoria Street, Montreal, and for metal windows to the Metal Shingle & Siding Company, Limited, 91½ Delorimier Avenue, Montreal. Painting not yet awarded.

Drummondville, Que.
The general contract for the erection of a powder works for the Aetna Chemical Company, Limited, 120 St. James Street, Montreal, has been awarded to Westinghouse, Church, Kerr & Company, 137 McGill Street, Montreal. Resident Engineer, Charles Henderson, Drummondville.

Fort William, Ont.
In connection with the stores being built on Victoria Street for J. C. Murray, the heating contract has been let to the Varlow Brass Foundries Limited, Syndicate Avenue S., the contract for plumbing to the Superior Heating & Plumbing Company, Leith Street, and for electrical work to the Western Electric Company, Victoria Avenue.

London, Ont.
The brickwork contract in connection with the stores being built on Dundas Street E. for J. M. Moore, 478 Waterloo Street, has been let to the general contractor, N. Southern, Renwick Avenue, the contract for ironwork to the Dennis Iron Works Company, 22 Dundas Street, and for lumber, doors, etc., to G. H. Belton, Rectory Street.

W. G. Meakins & Sons, Hamilton, have

let the general contract for repairs to the knitting mills on Dundas Street to L. J. Beatty, 175 Emerald Street, Hamilton, and the contract for steel work to Woodhall & Sinclair.

Montreal, Que.
The following contracts have been awarded in connection with the store and apartments erected at 128 Mansfield Street for Oscar Dufresne:—roofing, M. Chouinard, 751 Adam Street, Maisonneuve; painting, Penadre Bourdon, 160 Fifth Avenue, Maisonneuve; refrigeration plant, Canadian Ice Machinery Company, 82 Chestnut Street, Toronto; cork insulation and refrigeration doors, Canadian H. W. Johns-Manville Company, Limited, 450 St. James Street, Montreal; plastering, J. Lefebure, 150 Ontario St. E.

Ottawa, Ont.
The carpentry contract in connection with the stores and apartments in course of erection on Bank Street for Donald Fraser, 82 O'Connor Street, has been let to W. Thompson, 1093½ Wellington Street.

Quebec, Que.
The contract for heating in connection with a store in course of erection on St Joseph Street has been let to S. Domcarlos, Abraham Hill, and for electric work to Goulet & Belanger, Crown St.

In connection with the Union Station in course of erection at St. Paul and Henderson Streets, the contract for limestone has been let to the Chateauvert Quarry Company, 25 St. Paul Street, and for supply of brick to the Citadel Brick Company, 42 Dalhousie Street.

Sarnia, Ont.
The following contracts have been let for the erection of a store on Christina Street W. for Hubert Yard, 161½ Lochiel Street:—general and carpentry, D. Giffin, 289 Maxwell Street; masonry, E. McDonald; plumbing, F. Goodwin Company, 215 Christina Street W. Approximate cost, $4,000.

Springhill, N.S.
The contract for masonry and plastering at the branch erected for the Canadian Bank of Commerce has been let to Fage & Lusby, the plumbing and heating contract to J. C. Weatherby, the contract for painting to E. A. Potter & Son, Church Street, and for wiring to the Edison Electric Light Company, Main Street.

St. Catharines, Ont.
Newman Bros., 75 St. Paul Street, have been awarded contracts for the erection of an addition to the japanning building of the McKinnon Dash & Hardware Company, and of a storage building for the McKinnon Chain Company. Architects, Krumm & Lynar, Queen St.

St. John, N. B.
The contract for galvanized iron work at the building in course of erection on Prince William Street for the James Kennedy Estate has been let to James McDade, Mill Street.

Toronto, Ont.
In connection with the lodge, stable and garage in course of erection at Government House, Douglas Drive, the contract for paving has been let to Witchall & Sons, 156 St. Helens Avenue, and the carpentry contract to J. C. Scott Company, 108 River Street.

In connection with the pair of residences being built at 42-44 Fulton Avenue by J. F. Glennie, 10. Fulton Avenue, the contract for plumbing has been let to R. J. Ritchie, 851 Logan Avenue, and for plastering to B. Davidson, 1073 Davenport Road.

Westmount, Que.
The steel work contract for the stores and residences in course of erection on Sherbrooke Street for G. A. Dion, 4120 St. Catherine Street, has been let to the Dominion Bridge Company, Limited, Lachine, Montreal.

Residences

Agincourt, Ont.
A. Doherty, Ellesmere, Ont., is erecting a residence, estimated to cost $5,000, Brick construction, cement foundation, shingle roofing.

Ailsa Craig, Ont.
Thomas Risdale, Mill Street, is building a frame and roughcast residence, estimated to cost $3,200.

Work on the erection of a residence has been commenced by W. Clatworthy, Main Street. Frame and white brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Brantford, Ont.
Contracts will be let for heating, plumbing and electrical work in connection with the residence in course of erection at 161 Dufferin Avenue for E. B. Duncan, 104 William Street.

Erin, Ont.
Colwill, Boothe & Company, Union Bank Building, Guelph, are preparing plans of a residence to be erected for J. Coke. Stone and brick construction. Estimated cost, $4,500.

Guelph, Ont.
Colwill Boothe & Company, Union Bank Building, are preparing plans of a bungalow for James Simpson, Wellington Place. Tenders will be called shortly. Stone and brick construction. Estimated cost, $6,000.

Halifax, N. S.
Work has been started on the erection of a residence on Jubilee Street by the Eastern Investment Corporation, Cragg Building. Frame construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

The City Building and Land Company, 166 Hollis Street, have commenced the construction of a frame residence estimated to cost $4,000.

Work has been started on the erection of two residences on Oxford Street for the Eastern Investment Corporation, Cragg Building. Frame construction, shingle roofing. Approximate cost, $7,000 each.

James Hillis, c/o Hillis & Son, Hollis Street, has commenced the erection of a number of flats on Coburg Road. Estimated to cost $8,000. Frame construction, concrete foundation, shingle roofing.

Hull, Que.
The residence in course of erection for Edward Pelletier, Montcalm Street, is being built by day labor.

Mitchell, Ont.
The erection of a residence on Main Street E. is being considered by John Lehman, Logan Road.

Montreal, Que.
S. A. Brochu, 294 St. Catherine Street E., is building six flats on Iberville Street, estimated to cost $4,000.

A block of nine flats is being built on Chateaubriand Street by Pascal Latreille, 2597 Hubert Street. Approximate cost, $5,000.

Ottawa, Ont.
James Brownlee, 11 Clemow Avenue, has commenced the erection of a residence on Allan Street. Contracts will probably be let for heating, plumbing and electrical work. Estimated cost, $4,500.

G. A. Clark, 106 Kent Street, has prepared plans for a residence to be erected on McDonald Street at an estimated cost of $4,000. Brick veneer construction, stone foundation, shingle roofing.

Plans of a residence to be built on First Avenue have been drawn by E. F. Day, 240 First Avenue. Brick veneer construction ,stone foundation, shingle roofing. Approximate cost, $5,500.

Port Rowan, Ont.
W. P. Ferrie is preparing plans for a residence estimated to cost $3,000. Frame and white brick construction, concrete foundation, shingle roofing.

Quebec, Que.
A residence is being built on Fourth Avenue by day labor for E. Belanger, 331 Fourth Avenue, Limoilou. Sub-contracts will be let for roofing, plastering, painting, heating, plumbing and electrical work.

A residence is in course of erection on Lockwell Street for E. C. Brochu, 147 St. Cyrille Street. Work by day labor. Concrete foundation, brick construction, metal roofing. Approximate cost, $3,000.

Toronto, Ont.
S. Robertson, 1006 Logan Avenue, is receiving tenders on plumbing, plastering and electrical work in connection with the residences in course of erection on Berwick Avenue.

J. F. Alexander, 8 Temple Avenue, has let the contract for the erection of a residence at Temple and Dufferin Streets to W. B. Charlton, 412 Indian Road. Estimated cost, $5,000.

In connection with the residence being built on Melgund Road for R. Connable, 228 Balmoral Road, the contract for masonry has been let to Smallwood Bros., 97 Clinton Street, and for carpentry to J. C. Scott, 106 River Street.

R. E. Hicks, 192 Western Avenue, has let the plumbing contract in connection with the residence in course of erection at 103 Woodside Avenue to E. Hume, 146 Vine Street. Contracts for painting, heating and electrical work will be let.

W. A. Taylor, 4 Laurier Avenue, has commenced the erection of a residence at 182 Keewatin Avenue, estimated to cost $3,000. Smaller trades will be sub-let. Brick construction, shingle roofing.

S. B. Green, 650 Annette Street, has started work on the erection of a residence on Evelyn Crescent, and will sublet smaller trades. Brick construction, shingle roofing. Estimated cost, $3,000.

A. Edwards & Spiers, 1028 St. Clair Avenue W., have started work on a residence at 191 Lauder Avenue, estimated to cost $5,000. Smaller trades will be sub-let. Stone and brick construction.

A. R. Doherty, 56 St. Andrew's Gardens, has commenced the construction of a brick residence, estimated to cost $4,500.

A residence is in course of erection at 146 Glenholme Avenue, for C. R. Britnell, 73 Alberta Avenue. Stone and brick construction. Estimated cost, $5,000. Smaller trades will be sub-let.

The Reliance Building Company, 70 King Street E., are erecting three pairs of residences on Gerrard Street E., estimated to cost $10,200. Brick construction, shingle, felt and gravel roofing.

A pair of residences is being built at 134 Glenholme Avenue by day labor for R. T. Walker, 39 Frederica Street. Brick construction, stone foundation. Approximate cost, $8,000.

Tenders on smaller trades for the residence in course of erection at 76 Regal Road are being received by J. D. Naylor, 110 Glenholme Avenue.

Work has been commenced on the erection of a residence at 5 Wells Hill Avenue by L. J. Bland, 18 Vermont Avenue. Brick construction, shingle roofing. Estimated cost, $3,800.

W. H. Umphrey, 83 Wellesley Street, is erecting a pair of residences on Kent Road. Smaller trades will be let. Estimated cost, $6,000.

R. Robertson, 57 Armand Avenue, is receiving tenders on all trades required in the erection of an addition to his residence.

Work has been started on the erection of a residence on Thorne Crescent by J. Edmonds, 71 Oakwood Avenue. Smaller trades will be let. Approximate cost, $3,500.

Work has been started on the erection of a pair of residences on Gillard Street by J. R. Gifford, 195 Browning Avenue. Contract for smaller trades will be let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $3,500.

Vancouver, B. C.

A permit has been issued to B. J. Short for the erection of a residence at 966 Fourteenth Avenue W., at an estimated cost of $4,500. Frame construction. Architects, J. P. Matheson & Son, 509 Richards Street.

Victoria, B. C.

Tenders on the erection of a residence on Little Saanich Mountain will be received until 4 p.m., August 20th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at office of W. Henderson, Resident Architect, Victoria, B. C., at the Post Office, Vancouver, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Westboro, Ont.

W. Fields has commenced the erection of a number of residences, estimated to cost $4,500. Brick veneer construction, stone foundation, shingle roofing.

Windsor, Ont.

Labert & Braithwaite, 10 Reveri St., are erecting a residence, estimated to cost $4,000. Brick construction, shingle roofing.

CONTRACTS AWARDED

Agincourt, Ont.

Work has been started on the erection of a residence for Miss E. Armstdong, Agincourt. The general masonry and carpentry contracts have been let to W. H. Patterson, Agincourt. Smaller trades will be let by the general contractor. Approximate cost, $5,000.

Galt, Ont.

The following contracts have been let in connection with the erection of a residence at Brant and Aberdeen Streets for J. R. Blake, Gilholm Avenue:—brickwork and masonry, Thomas & Hancock, Wellington Street; carpentry, George Murray, Victoria Avenue; plastering, Will Mogg, Brant Road; painting, A. G. Bruce, Main Street; heating, plumbing and electrical work, Scott & Bennett, Water Street N.

Halifax, N. S.

In connection with the residence in course of erection on Young Avenue for A. O. Saunders, 14 Lucknow Avenue, the masonry, carpentry and steel contracts have been let to the general contractors, Rhodes Curry Company, Windsor Street, the painting contract to Martin & Moore, 247 Barrington Street, and the contract for heating, plumbing and electrical work to Farquhar Bros., Barrington Street.

Frank Settle, Cole Harbour Road, is building a number of flats on Walnut Street for Gertrude Settle. Frame construction, concrete foundation, felt and gravel roofing. Estimated cost $3,000.

Herbert Hartlen, 299 Gottingen Street, has let the general contract for the erection of three residences on Longard Road to Guzer Bros., care of owner. Frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $6,000.

Hamilton, Ont.

W. C. Armstrong, 119 Hugson Street S., has let the masonry contract for the erection of a residence on Burris Analon Place to Isbister Bros., 125 Wellington Street S., and the carpentry and roofing contract to J. Vickers, 258 Rosslyn Street W. Other trades not yet awarded. Estimated cost, $4,500.

Montreal East, Que.

The general contract for the erection of thirty residences on Dube Avenue for Cie de Construction de Maisons, d'habitation Salubre, Ltd., has been let to C. Durocher, Montreal East. Estimated cost, $75,000. Brick construction, felt and gravel roofing.

Ottawa, Ont.

Work has been started on the erection of a residence on Wendover Street for I. M. Bower, 133 Hopewell Street. The heating and plumbing contract has been awarded to J. Gervin, Bank and Sunnyside Streets, and the electrical work to Dominion Electric Company, 417 Sparks Street.

Work is under way on the erection of a residence on Centre Street for F. Carl, care of the McAuliffe Lumber Company. The masonry contract has been let to R. Beattie, Renfrew Avenue. Lumber will be purchased from the McAuliffe Lumber Company. Approximate cost, $5,500. Brick veneer construction, stone foundation, shingle roofing.

In connection with the apartments in course of erection for J. Lorne Graham, 202 Laurier Avenue W., the plastering contract has been let to Thomas Jarvis, 18 Fourth Avenue.

In connection with the apartments in course of erection at Laurier and Chapel Streets for Leon Petegorsky, 87 Goulbourne Avenue, the contract for brickwork has been let to A. St. George, Somerset Street E., and for electrical work to L. Stewart. Carpentry and roofing will be done by owner Plastering and painting not yet awarded.

In connection with alterations to a residence on James Street for P. J. Powers, 432 Wellington Street, the painting contract has been let to W. Howe, 318 Bronson Street, and the wiring contract to Costello & Crowe, 380 Bank St. Heating and plumbing will be done by day labor.

Quebec, Que.

J. Carmichael, Notre Dame des Laurentides Street, has commenced the erection of a residence, estimated to cost $6,000. The masonry and carpentry contracts have been awarded to Dallaire & Tremblay, 194 Fourth Street, Limoilou. Frame and brick construction.

Sherbrooke, Que.

In connection with the residence erected on Brooks Street for W. J. McManamy, Moore Avenue, the contract for heating and plumbing has been let to O. Trudeau, 227 Wellington Street, and for electric wiring to the Electrical Repair & Supply Company, 71 Wellington Street.

Westmount, Que.

The contract for heating and plumbing at the residence in course of erection on Westmount Boulevard for Mrs. L. C. Fee has been let to F. J. Friedman, 357 St. Catherine Street W.

Winnipeg, Man.

The electrical work and plastering at the residence in course of erection on Niagara Street for Purcer Bros., 501 McIntyre Block, will be done by the owners. The painting contract has been let to Thomas Sutton, 35 Stratford Hall. Winnipeg.

Winthrop, Ont.

The general contract for the construction of a residence for J. H. Campbell has been awarded to Charles MacNamara, Seaforth, Ont. Approximate cost, $4,000.

Power Plants, Electricity and Telephones

Brantford Township, Ont.

Negotiations are now progressing between the Township Council and Brantford Hydro-electric Commission for the construction of a power transmission line. Engineer, L. C. Ireland, Brantford Hydro Electric Commission, 7 George Street, Brantford.

British Columbia Province

The British Columbia Telephone Company, 555 Seymour Street, Vancouver, are contemplating considerable extensions in the Fraser River Valley. White Rock, Cement Beach and Ocean Park will be connected with Cloverdale, involving the construction of 28 miles of line.

Hamilton, Ont.

The Great North Western Telegraph Company, the Bell Telephone Company and the C. P. R. Telegraph Company are about to install all their lines in underground conduit.

Palmerston, Ont.
A by-law providing for the installation of a hydro-electric system will be submitted to the ratepayers on August 7th. Town Clerk, H. Hyndman.

Petrolia, Ont.
A by-law has been carried authorizing a bond issue of $35,000 for the installation of a hydro electric system and plant. Town Clerk, J. McHattie.

CONTRACTS AWARDED

Zelma, Sask.
The contract for the construction of a telephone system for the Zelma Rural Telephone Company has been let to George Foley, Box 355, Saskatoon, at $6,725. Equipment for about 35 miles of line and 35 phones will be purchased by contractors.

Fires

Berwick, N. S.
Fire has destroyed the planing mill of J. W. Hutchinson, Commercial Street, causing a loss of $10,000. The evaporating plant of the Berwick Fruit Company, Mill Street, was also damaged to the extent of $1,500.

Chicoutimi, Que.
The store and residence of J. T. Laferriere have been destroyed by fire. Loss, $7,000, covered by insurance. Owner will rebuild.

Ditchfield, Que.
Fire has destroyed the saw mill belonging to P. H. Renaud. Loss, $6,000, covered by insurance. Owner will rebuild.

La Tuque, Que.
Omer Giguere's garage has been totally destroyed by fire. Loss, $9,000, covered by insurance. Owner will rebuild.

Little River, N. S.
A. Thomson's residence and outbuildings have been completely destroyed by fire.

Martintown, Ont.
Fire has destroyed A. D. Clingen's sawmill. Loss, $8,000.

Orillia, Ont.
The Municipal Building and Opera House have been destroyed by fire. Estimated losses, Town, $25,000, insurance $19,000; T. W. Robbins, lessee of the Opera House, $3,000, small insurance. The Town Council have decided to rebuild, and will ask for competitive plans. Clerk, C. E. Grant.

Plaster Rock, N. B.
The following properties have been destroyed by fire:—hotel, owned by Washburn Turner, grocery store, C. L. Bent, residence, George Ridgewell.

St. Theodore d'Acton, Que.
The following losses have been caused by fire:—bakery and residence, Hector Belanger, $6,000, covered by insurance; store and residence, Mrs. N. Decelles, $7,000, fully insured. Both owners will rebuild.

Fire has destroyed the grist mill, blacksmith shop and residence of Rene Desantels. Loss, $10,000. Owner will rebuild.

Wallaceburg, Ont.
A business block has been destroyed by fire, with a loss of $5,000. Occupants, Jones & Bachus, proprietors of the Ideal Laundry, A. Sterling, store, and Chinese laundry.

West Broughton, Que.
A saw mill belonging to T. Beaudouin has been destroyed by fire. Owner will rebuild next year.

Miscellaneous

Berlin, Ont.
Tenders on the supply of a street sprinkler and flusher will be received until July 29th by the Chairman of the Street Sprinkling Committee.

Colborne, Ont.
A by-law providing for the purchase of a fire engine has been passed. Town Clerk, H. S. Keyes.

Halifax, N. S.
A. A. McDonald, Water Street, Halifax., is in the market for builders' and woodworker's supplies, plant and machinery.

Levis, Que.
The City Engineer, C. Lessard, has been authorized to purchase a carload of pipe clay.

New Brunswick Province
Tenders on dredging at Grand Lake, St. John River, will be received until 4 p.m., August 3rd., by R. C. Desrochers, Department of Public Works, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, and at the Department. Approximate quantity, 75,000 cubic yards.

Springhill, N. S.
The Springhill Manufacturing Company are receiving prices and catalogues on plate glass, fireproof doors, metal sash shutters, skylights and ventilators.

St. Joseph, Ont.
N. A. Cantin, St. Joseph, Hensall, Ont., is in the market for a quantity of cement.

St. Thomas, Ont.
The St. Thomas Construction Company, Limited, are in the market for machinery for the manufacture of shrapnel and high explosive shells and other ammunition. A. E. Ponsford, 605 Talbot Street, is an interested party.

Yamachiche, Que.
Quotations and catalogues on plumbing, heating and ventilating supplies and equipment are being received by N. Deschesne & Company, Three Rivers.

CONTRACTS AWARDED

Chatham & Dover Townships, Ont.
A contract for dredging has been let to Alexander Clifford, 701 Centre Avenue, Bay City, Mich., at $29,323.

Transcona, Man.
The Town Council have let the contract for the installation of an incinerator to the Ideal Incinerator Company, Manning Arcade, Toronto, at $18,875.

Late News Items

Assiniboia, Man.
Tenders on laying watermains will be received until August 2nd by Frank Ness, Kirkfield Park.

Edgeley Station, Sask.
Tenders on the erection of a school for the Trustees of Donamar Rural School District No. 3570, will be received until August 5th by R. B. Heron, Avonhurst P. O., Sask. Plans and specifications at office of the Western School Supply Company, Regina, and with William Rogers, Edgeley, Sask.

Exeter, Ont.
A by-law has been carried, providing for the installation of a hydro-electric system, at an approximate cost of $20,000. Work to be done under supervision of the Engineers of the Hydro Commission.

Grantham, Ont.
A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, is receiving tenders on the erection of a two-roomed school on Queenston Street, School Section No. 6. Concrete foundation, brick and tile construction.

Lac au Saumon, Que.
A contract for water-works construction has been let by the Municipality to A. Landry & Fils, Lac au Saumon. Approximate cost, $19,000. Wood pipe, douglas fir and cast iron pipe will be required.

Markham, Ont.
E. A. James, 57 Adelaide Street East, has submitted a report to the Village Council estimating the proposed extension to the water-works system at $15,000. This figure includes a standpipe with a capacity of 60,000 gallons.

Montreal, Que.
Work has been commenced by D. Lamoureux, 1923 St. Lawrence Street, on the erection of six flats on Mozart Street, estimated to cost $6,000.

Orillia, Ont.
The residence of Benjamin Cole on Hilda Street has been completely destroyed by fire.

Starkville, Ont.
The sawmill owned by F. Jackson has been completely destroyed by fire.

St. Catharines, Ont.
The general contract for the erection of a business block on James Street for J. Balsam, 29 James Street, has been awarded to Newman Bros., 75 St. Paul Street. Approximate cost, $15,000.

Tilbury East Township, Ont.
The Township Clerk, A. Farquharson, Merlin, will receive tenders until August 2nd on dredging the Dauphin Drain and on road grading. Plans at office of Clerk.

Tuckersmith Township, Ont.
Tenders on new flooring for four bridges will be received until August 4th by D. F. McGregor, Seaforth.

Welland, Ont.
Frank Springer, 59 Merritt Street, has prepared plans of a store to be built on Burgar Street for Samuel Lambert, 56 Main Street N. Estimated cost, $10,000.

Winnipeg, Man.
Tenders on the installation of a heating system at the Polson Avenue School will be received until August 5th by the Public School Board.

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Ancient Cities with Ancient Methods

EVERYONE has heard of the king who went down into history as the man who "never said a foolish thing nor ever did a wise one." King Charles voiced praiseworthy sentiments, but never took part in putting them into effect.

Times change. Now it is not difficult to find men, and bodies of men, whose foolish actions are unredeemed by the saving grace of even word wisdom. Take for instance the Builders' Association of Quebec who recently passed a lengthy resolution protesting against the award of contracts to outside firms and expressing the hope that "Directors of banks, companies, and all other enterprises will strive in future to encourage Quebec contractors by preference." (A postscript is added to the effect that lists of general contractors and those engaged in the various trades can be obtained at the offices of the Association).

The only effect of resolutions of this kind is to attach to a community the stigma of insularity. The progress of Quebec City has been retarded and will be retarded, by just such methods. Dominated by such influences the "ancient capital" will remain the "ancient capital" until the crack of doom.

In such a day as the present when so little business is to be had, it is only fair that local contractors should have the preference, **other things being reasonably equal,** but every town or city or community that openly advocates a policy of exclusion is promoting something inimical both to national and private interests. If the business of the country is to be sustained, the towns, cities and communities of the country must work together and promote their business collectively. Scattered effort is lost in the attainment of national development.

It is to be hoped that by the time the city of Quebec is as old again she will have learned the wisdom of promoting competition at all sacrifice, just as her younger sister, Montreal, is beginning to profit by expensive experiences by no means far removed.

An Example to be Avoided—From Quebec

ON MORE than one occasion we have referred to the discourteous treatment—to use a mild expression—which contractors now and again receive at the hands of municipalities. The conditions under which they tender are sometimes unnecessarily severe and are only tolerated under stress of keen competition. Contractors are expected to live up to the strict letter of the specifications and conditions, while councils, in too many instances, act as of they were above the law, and if it suits them disregard the conditions which they have themselves drawn up. These conditions are set aside regardless of the hardships and expense to the contractors, and often it requires the intervention of the law to prevent injustice from being done. Members of councils will act in their public capacity in a way which they would repudiate as private citizens.

A flagrant example of unfair dealing with contractors has just occurred at Chambly Basin, P. Q., where the council advertised far and wide for tenders for sewer and sidewalk work. The invitation resulted in numerous bids being received, many of the firms being represented at the meeting at which the tenders were to have been opened. But a little surprise was in store for these firms. Before the tenders were considered, a Montreal contractor requested that the time for receiving tenders be extended, on the ground that he had only just learned of the work. There was a vigorous protest from the other representatives, who had complied with the advertisement. The Montreal man, however, was persistent. Then some local contractors, who of course could not plead ignorance of the date of closing, asked for permission to bid.

The lawyer of the council was consulted and advised that the members would be within their rights in postponing a decision on the tenders. The representatives of the firms who had tendered asked that, in this event, they be allowed to withdraw their offers, and to make new prices. This request was disregarded, and by the casting vote of the mayor it was agreed that the tenders be not opened on that occasion; that other firms be allowed to put in bids, and that all the bids be considered three days later.

The entire proceedings will, we think, strike most men as unbusinesslike, unfair and contrary to the spirit, if not to the actual letter, of the advertisement. A definite time for the closing of the tenders was fixed, and any contractor who was even a minute late was barred; yet we find the council deliberately breaking their own conditions, and allowing men who were cognisant of the date of closing, and who had neglected their opportunity, to enter the competition for the work. Even if they had the excuse of ignorance it was manifestly unjust to postpone a decision in order to allow them to tender. These late-comers had a possible advantage over those who complied with the conditions. Every tender had to be accompanied with a cheque of ten per cent. of the price, and it was possible that the amounts of these cheques might leak out, thus giving an approximate idea of the tenders. If such knowledge could be secured it is apparent that under-bidding by local men would be an easy matter. Even on the supposition that leakage was impossible, the occurrence of similar incidents is strongly to be deprecated as being irregular and prejudicial to the interests of contractors and councils.

Portable Houses for Europe

If there is any truth in the report as to the impending orders for portable structures on a scale of millions of dollars, one of the most important industries identified with constructional operations will benefit materially and business throughout the whole field will receive a decided impetus. The report is that the British Government has been negotiating for the purchase of all kinds of portable structures to be taken to Northern France and Belgium to replace temporarily the dwellings, churches and schools which have been laid low in that ravaged territory. At the time of going to press a large Brooklyn firm has been mentioned in connection with one of the most important contracts which are to be awarded, but the requirements are on such a huge scale that Canada cannot fail to receive a share of the business and let us hope a considerably greater share of subsequent orders of the kind.

It is said that the contracts now pending include one for the construction of 20,000 portable houses—the largest single contract ever given for buildings of this type. Entire cities and towns are being created from them to house the refugees made homeless by the high tide of the German advance into France. The buildings are to be so constructed that they can be set up quickly upon their arrival in France. Shipment is to begin early in the fall if the contract goes through, and all the work is expected to be completed by the winter. The fact that such huge orders are in the air suggests that Canadian manufacturers should look into their resources and capabilities, and take enterprising measures to secure a share of the business.

There has been some criticism of the idea of placing such orders in the United States, but it devolves upon us first to show that we are capable of handling such business—and this we can do.

Enquiries made by our contemporary the Canada Lumberman would indicate that many Canadian plants are in an excellent position to meet the requirements of any such contracts and that a large number of factories having the best possible equipment for such work are not running at anything like their full capacity. Many of these quote close prices and give as good delivery as any United States plants. This claim was put forward very strongly in a letter to our contemporary. The Schultz Bros. Company, Limited, write:—"The manufacture of portable houses requires special manufacturing facilities and familiarity with technical details differing from those of ordinary building operations. There are plants in Canada which are able and ready to handle orders of this kind, and in our opinion the entire order in question could be conveniently handled within the required time.

"It seems to us that those mediums through which such orders are placed on behalf of the Imperial Government, should in the first place ascertain the ability and the capacity of Canadian plants before going to American concerns. Our Canadian Manufacturers' Association at the present moment could establish another field of activity besides those they so ably carry on, a sort of Clearing House for War Supplies, through which the various Canadian plants could establish their ability and capacity of handling war orders and through which the Government could ascertain what kind of orders our Canadian manufacturers could handle. For certainly our Canadian loyalty to the Empire entitles us to that consideration, the more especially as we should handle such orders not merely for the money consideration, but with that special attention which our patriotism and loyalty inspire. And such a clearing house would be free from baneful political influences."

The stand is well taken that Canadian firms have not been as wide-awake to their opportunities for war contracts as they should have been, and that energetic, concerted action on the part of the manufacturers will yet prove a most profitable business policy.

The famous Culebra Cut on the Panama Canal has been renamed "Gaillard Cut" by order of President Wilson, in honor of the late Lieut.-Col. D. D. Gaillard, Corps of Engineers, United States army. The President, in his order, says: "As a member of the Isthmian canal commission from March 16, 1907, to December 5, 1913, Lieut.-Col. Gaillard was in charge of the work in Culebra Cut until its virtual completion, being compelled to abandon his duties in July, 1913, through an illness which culminated in his death on December 5, 1913. His period of Panama canal service included the years of most active construction work. He brought to the service trained ability of the highest class, untiring zeal, and unswerving devotion to duty. I deem it a fitting recognition of Lieut.-Col. Gaillard's service to the country to rename in his honor the scene of his life's triumph."

Progress of Construction on the New Welland Ship Canal

INFORMATION covering the progress of construction on the new Welland Ship Canal to date has been furnished by Mr. J. L. Weller, the engineer in charge of this great undertaking. Dividing the work into four sections, in submitting his data Mr. Weller has described the progress on each section separately. Referring to section No. 1 Mr. Weller says:

The new harbor at the Lake Ontario entrance to the canal is now well under way. The entrance channel is being formed by the construction of two earth embankments that will extend one and one-half miles into the lake; these embankments have now reached a point about 5,000 feet from the shore line and contain approximately 1,800,000 cubic yards of material.

Fair progress is being made with dredging operations in the entrance channel, three dredges having been engaged at this work all last season, and the same number are at present employed, but owing to the hard nature of the underlyinb material progress is necessarily slow.

Concrete Cribs and Retaining Walls—Dry Excavation

The reinforced concrete cribs that will form the substructure of the entrance piers at the end of the embankments are being built at Port Dalhousie, the entrance to the present canal, 3 miles west of Port Weller. These cribs are 110 feet long, 38 feet wide, and 34 feet high, and 53 of them will be required for the entrance piers and the docking in the harbor. One crib was constructed last season and three more have been completed so far this year. The contractors expect to build about 18 of these cribs during the present season.

The construction of the reinforced concrete retaining wall, which will extend along the west side of the harbor for 2,000 feet, is nearing completion. The contractors are at present engaged in building the west lock wall of Lock No. 1, and concreting on this structure has been rapid during the past few months. The standard lock wall is a mass concrete structure 81 feet 6 inches in height and 46 feet wide at base.

The dry excavation on section No. 1 is practically completed, the material having all been disposed of in the east harbor fill. A good deal of the excavating plant has been rented to the contractors for section No. 2, who are disposing of their excavated material in the west harbor embankment, and a cross-over is at present being constructed to enable these contractors to dump on the east side of the harbor.

The upper-entrance walls to Lock No. 1 will be built upon a timber-pile foundation, the piles for which have all been driven.

Breast Wall for Section 2

The work on section No. 2 during the present season, outside of ordinary dry excavation, has consisted of the construction of the breast wall at the head of Lock No. 2. The pit for this wall was taken down 69 feet to rock, states Mr. Weller, who thus described the methods employed:

The method of excavation adopted was to drive steel sheet piling to refusal and excavate material to the bottom of the piling, after which piling was re-driven and the material excavated to rock. Concreting on this wall is now up to ground level, and the remaining 6 feet will be completed soon. The upper entrance walls to Lock No. 2 will also be built on a pile foundation, the piling for which has been driven and the seat prepared, and concreting in the west-entrance wall is now under way.

The contractors for this section have removed approximately 2,500,000 cubic yards of earth excavation during the past year, the bulk of it being disposed of in the harbor embankments.

The next structure to be started will be the breast wall of Lock 3, and the method of construction will be similar to that employed at Nock No. 2.

Some work has been done on concrete protection to banks, this consisting of a 6-inch slab of concrete laid upon 8 inches of broken stone, and extending 5 feet below and 5 feet above the water line, the base of this concrete protection resting on a 5-foot berm in the canal bank.

Mr. J. L. Weller, Chief Engineer, Welland Canal System.

Rock-Crushing Plant for Section 3

Section No. 3 comprises the flight locks Nos. 4, 5, and 6, in pairs, single Lock No. 7, and two diversions of the Grand Trunk Railway. These railway diversions have been completed, and the contractors are making good progress now with rock excavation on the site of the twin locks. This work involves the excavation of solid rock to a depth of approximately 80 feet for Twin Locks 4 and 5 and single Lock No. 7. There are five steam shovels engaged in this work at present and a number of electric drilling machines, and material is being removed at the rate of about 75,000 cubic yards per month.

Of the rock-crushing plant Mr. Weller says:

All of the good rock excavated is being crushed for concrete, the contractors having been obliged, under their agreement, to erect a rock-crushing plant with a capacity of 4,000 tons a day. This plant has been in operation for some months, and stone for concrete is now being supplied to the contractors for sections Nos. 1 and 2. The dam at the head of Lock No. 6 is progressing satisfactorily, two dragline machines being engaged in rehandling material from storage piles, either side, into the dam, and the material is being compacted by steam rollers. The dam is now built up to a height of about 15 feet above the natural ground level. The upper west entrance wall to Lock No. 6, which was started during the fall of 1914, has been completed.

Pile driving is now being carried on for the east entrance wall of Lock 6, and concreting in this wall will be started within a short time.

Work on section No. 4, which consists of widening and deepening the present canal, is progressing rapidly, five steam shovels being employed in the dry excavation to widen the present canal banks, and to June 1, 1,250,000 cubic yards of material have been removed and disposed of on the low land to the west of the present canal. No further sections have been placed under contract to date.

A construction railway to haul excavated material to the dump in the lake and crushed stone from the crushing plant on section 3 is completed, with interlocking and block signal system, telephone dispatching, etc., and is being operated at present to almost its full capacity.

Mr. Weller believes the $50,000,000 waterway will be ready to open in 1918. While the war has had the effect of delaying the letting of some of the contracts, in other particulars the progress made so far is entirely satisfactory to him.

New Methods Evolved in Building World's Largest Bridge*

Quebec Erection Takes Care of Members Spliced Between Panel Points by "Flying Falsework" and Erection Trusses—Travelers Unique for Size and Central Operating Control

REMARKABLE erection problems solved by unique and effective methods characterize at every turn the greatest bridge building undertaking that has ever been attempted. The main members of the Quebec bridge are so huge that most of them have to be spliced between panel points, and these spliced halves further split lengthwise into two and even four parts for shipment and erection. The field work of fitting these parts together was only made possible by shop work of unprecedented accuracy. This splicing also made necessary extraordinary means of support between panel points for many of these members during erection.

A vertical hoisting range of 320 feet was required of the erection tools, within which height 90-ton members must not only be handled, but handled in pairs, and with speed and accuracy. The size and weight of the trusses made it desirable to have erection progress on both sides of the bridge exactly simultaneous. This condition has been met and turned to positive advantage.

To deliver material to the piers at the river's edge for simultaneous erection of the anchor and channel arms would have required expensive trestles and a double outlay for erection plant. On the other hand, to erect the anchor arms first has required heavy falsework, some of which at least must remain in place until the river work is well along, since the top chords of the bridge are tension members, and the stress in them could not be reversed without going to great expense in their construction.

Order of Erection on Anchor Arm.

The floor system of the north anchor arm was erected on interior falsework consisting of steel towers, topped by heavy plate girders on which the floorbeams of the bridge rest directly. The traveler, running on outside tracks on this floor system, completed this operation from abutment to pier. It then moved back, setting steel columns at each panel point under each truss and erecting the bottom chord as it went. It next traveled back to the pier, the move being made in a few hours, and began erecting each truss to the subpanel points above the floor system. The floorbeams were then connected to the trusses and no longer required the support of the first set of staging. The traveler then erected the upper part of the trusses, completing the span as it moved out for the last time. The falsework that had carried the floor system was removed behind it. This was promptly shipped across the river and re-erected under the south traveler, which had just been set on the south abutment.

The bank on the south side is higher than that under the north anchor arm, but the steel towers of the falsework were designed so that a section unbolted and removed from each left them the proper length for their new positions. This interior falsework weighs 2,500 tons, while the outer towers under the panel points, which must remain in place until the river arm is erected, and which alone had to be duplicated for the south anchor arm, weigh but 500 tons.

Tower Travelers Equipped With Cranes and Booms.

The 1,000-ton travelers that are handling this erection are themselves without precedent in design and operation. The main bridge tracks are left clear for steel delivery, and additional girders outside them carry the traveler tracks. A square steel tower, comparable in height and weight of members, is surmounted by a trussed bridge, overhanging either side of the tower parallel to the main trusses. On top of this bridge are two traveling cranes, each crane carrying two hoisting machines. These main hoists are mounted back to back on the crane girders, and each operates a ten-part fall. In order to keep the heavy machines as near the centre of the bridge as possible, the hoisting cables are led over sheaves mounted on trolleys connected to the main hoists and moving with them. An auxiliary crane is mounted on the outer end of each of the main cranes. These auxiliaries are moved by hand power, but are provided with power hoists. They handle pin-driving cages, riveting platforms and light loads.

In addition a steel boom is mounted half way up each corner post, each boom swinging by power through 270 deg. The four hoists controlling these booms are banked on the operating deck, over the tracks, on the land side of the traveler. Just under them is the transformer house—for the sole power used for all the erection is electricity from neighboring power developments. At the front of the operating deck is a bridge from which all sides of the traveler are visible. Here are the controls for operating the cranes on top. The motors for the hoisting and traveling motions, however, are mounted on the cranes above, and draw current from a multiple-unit contact system on the deck of the top bridge. A man is stationed at each hoist, with a telephone to the control deck at his elbow in case of accident. An electric elevator connects the crane deck with the operating deck. The traveler is mounted on four trucks provided with eight wheels each, and is moved by two sets of wire-rope falls, to which two of the derrick falls are luffed for pulling.

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*Abstract of progress report by The Engineering Record.

With this traveler it is possible to set the corresponding members of each cantilever truss at one operation. The members are loaded each on two short, heavy lorry cars, and pushed out to the bridge head side by side on the main tracks by dinkeys. The front crane is spotted, and its trolleys are run in to the sides of traveler.

A two-part fleeting tackle is hooked into two open-sheave blocks on the inside of the lifting beams on each set of falls from this forward crane. This fleeting tackle draws in the opposite blocks of the crane to the main tracks. The open-sheave blocks are mounted on a centre strap, and the fleeting tackle, consisting of a single long sling of wire rope, needs only to have the bights of each part thrown behind the sheaves to engage the blocks. The two ends of the sling, which are on top, are then picked up by one of the forward booms, drawing the main falls in over the track until they can be hooked up to the forward ends of the members to be set. The ends of these members are then raised, and the crane which has hold of them is moved forward.

Meanwhile the derrick holding the fleeting tackle booms out and picks up its load, and the dinkeys push out the rear ends of the two members, which still rest on the rear lorry cars. When the back hitching point of these members comes in front of the traveler tower, where the rear crane can reach it, the falls of this crane are fleeted in by the other forward boom and attached. The members are then raised clear and the cranes run out in position to set them, one raising its ends as the other lowers until the members reach the proper inclination for entering. The fleeting tackles are slacked as soon as the members are in the clear, and are cast off by four men, one of whom rides each lifting beam, by throwing the bights of the slings out of the open sheaves. The members are then lowered or raised to place and connected. With the centralized control of the traveler it is possible to move the cranes and booms together as if they were interlocked, with little signalling and a minimum expense of lung power. The two 73-ton inner halves of the upper half of the lower subdiagonal in the cantilever panel next the north pier were set in this manner inside of forty minutes.

Two general types of lifting hitch are used. They bushed in a large pin-hole of a member, while in the other the lifting pin passes through holes in special are identical, except that in one the lifting pin is lifting angles bolted to the back of the member.

"Flying Falsework."

The vertical tension members from the subpanel points to the bottom chord are erected after all the diagonals for the panel are in place. To make the pins in these posts, as well as to support the bottom-chord members until they are placed, some kind of falsework from which to jack was practically necessary. Such falsework was also required for another reason. The four parts of each bottom-chord section, spliced in the centre, must be erected and matched up on something solid in order to obtain workable results.

A lattice truss, lying flat in the plane of the bottom chord, with a set of heavy girders under each chord member, was devised for this service. Its rear end is supported from the pier for the first panel, and hung from the last bottom-chord panel-points for the rest of the erection. Each side of its "flying" end is hung by two ties, each consisting of one long and several short pairs of eyebars from the last subpanel points erected. The length of these ties is adjusted for each succeeding panel by means of the short eyebars at their lower ends.

On top of the girders of this truss, under the splice and under the outer end of each bottom-chord sections, are set four 100-ton hydraulic jacks to make the necessary adjustment. This bridge is raised by the main traveler by means of two pairs of lifting angles, and can be slid forward one panel and reset in a minimum of time.

The lower diagonal members are erected after the first half of the bottom-chord, which is the first member set in each panel. They are supported by guy tackles of wire rope attached to the subpanel points last erected. These tackles are pulled to the required tension by the derrick booms and clamped off with heavy, copper-lined eight-bolt cable clamps before the lifting tackles are loosened. They provide ready adjustment in making the pin connections with the other members meeting at the subpanel point. The outer ends of the bottom-chord members are next set. Then the remaining diagonals of the panel are erected. After the lower vertical members have been placed the upper posts are set, and last the top-chord members are placed. This chord is composed of two lengths and two banks of eyebars. To support the centre pin during erection each panel length is packed inside a light riveted truss, which spans the panel, but takes no stress as a member of the bridge. The eyebars are packed in these trusses in the bridge yard, and hauled to the traveler and erected as a unit.

Safety Provisions Necessary for Rapid Erection.

Pin-driving cages, provided with chain blocks for raising and inserting the pins, and holding the ram, are handled by the auxiliary cranes. These cranes also handle the riveting stages. A small electric winch mounted on the top of each main post drags a traveling riveting platform up each chord from panel point to panel point. These two platforms are connected by an ample runway with handrails carried on the top ties between the main trusses. Ample and solid stairways and wide, safe platforms are provided everywhere. Electric elevators are also installed to connect the track level with the ground at each abutment.

As a result of these provisions the men do not have their energies dissipated by holding to precarious perches while trying to work, and are able to get from point to point on the trusses without tiring themselves out in order to get to their work. Attention to these points would, it is believed, pay on any erection, but on a bridge of this size this is essential to progress. The cantilever arms of the bridge must be riveted practically as fast as they are erected, not only for safety, but because erection stresses would displace any riveted connections left drifted or bolted in the ordinary way and make it impossible to rivet them later. On the speed of this work, therefore, hangs the whole erection progress and everything is done to facilitate the riveting.

Good Shop Work Helps Erection.

The shop work on these large members is of the finest and the money spent on it has made erection accurate and easy. Although the fact is so incredible that the engineers are loth to be quoted about it, it is a matter of common knowledge at the bridge that the top pins of the main north posts, which are 310 feet high, and contain six splices, were erected within 0.002 feet of their calculated elevation for the prevailing weather conditions. Precise checks only confirmed the accuracy of the first measurement.

The north anchor arm has been erected and the north cantilever begun. It and the south anchor arm will doubtless be finished this season, as from 600 to 800 tons a day are being erected by each traveler. The north traveler next year can erect the suspended span. For this purpose its tower will be shortened by taking out two of the panels. The suspended span will be erected on towers, over the water at high tide, but on ground which is bare at low tide. The concrete footings for this falsework are now being placed. Meanwhile the south traveler can erect the south cantilever. The suspended span will then be floated into place and connected at the ends of the cantilever arms. There is nothing to prevent carrying out this program, as fabrication is well advanced. The steel for the north cantilever is practically all at the site, as is that for the south anchor arm, and also some of that for the south cantilever.

Yards Equipped With 90-Ton Cranes

The steel is unloaded by the yard cranes and locomotive cranes in a large yard on each bank of the river, back of the approach tracks to the bridge. Here it is sorted and stacked and the top chords and lighter long diagonals, shipped in section, are fitted together by the 90-ton traveling yard cranes. Members are loaded up on lorry cars as wanted and hauled to the bridge-head.

The personnel assembled by the erection of this bridge includes Mr. C. N. Monserrat, Chairman and Chief Engineer of the Board of Engineers, Quebec Bridge; Mr. Ralph Modjeski, and Mr. C. C. Schneider, consulting engineer to the board, and Mr. H. P. Borden, assistant to the chief engineer. Mr. J. D. Wilkens is in charge of erection for the board as resident engineer at the bridge. With the St. Lawrence Bridge Company, which has the contract for the fabrication and erection of the steel, is associated Mr. S. P. Mitchell as consulting engineer. George F. Porter is erection engineer for the contractor, while Mr. William Fortune is in charge of all erection as superintendent.

The relative merits of cast iron and vitrified stoneware pipes for house sewer drains has been exhaustively investigated for a year by Mr. A. C. Shaver, Chief Sanitary Inspector of the City Government of Passadena, Cal. The judgment of that body on their officer's report is in favor of the cast iron pipe, and they have made an order that in future that pipe alone shall be employed in their area. The conclusion arrived at is that cast iron pipes can be made root-proof at the joints and can be thrown out of alignment without breaking, whilst the slightly higher initial cost does not justify the risk of having to tear up the entire sewer to clean it.

More Steel in Bridges

PRESENT low steel prices emphasize and reinforce a movement that has been going on steadily for some years past. Structural design in times gone by had as its ideal the production of structures of minimum quantity of steel. Excellence of general design, soundness of details and resistance to the various attacks of time were neglected elements in comparison with the matter of satisfying certain computed stresses by the fewest pounds of steel. We are in a period of reaction from this school of design. The movement is toward heavier, more substantial design.

Sound designing is not a mere problem of arithmetic, in engineering any more than in architecture. There are many factors vital to the finished structure which do not appear in the force polygon. To take them into proper account calls for a well-ripened judgment; their requirements will often conflict, and the solution must be a compromise.

Let an instance of this be taken in the old and yet obscure conflict between flexibility and rigidity of structure. In past times this was responsible for the existence of two different groups of designers—one aiming to cushion impact and damp out vibration by building resilient structures, the other holding to the view that the most rigid and solid support, a rocklike absence of all yielding quality, is the ideal structural condition. The opposition between these views still exists in part, but we have progressed a little ,and know that both views are partly right. What we seek therefore to produce to-day is an aggregate that contains both rigid and yielding elements, providing flexibility where primary impact is received or where other secondary effects of unmanageable character occur—as expansion or distortion—and, on the other hand, providing a highly rigid construction in the main frame.

This instance well exemplifies how the non-calculable elements of design must be handled on the basis of experience which develops from thorough intimate study of structure, service and material. All the workings of this judgment from experience, however, lie beyond the field of mere sectional-area computations, and may lead to conclusions which seem to violate the requirements of close economy of metal.

Let the inquirer into this subject note the contrast between modern and old-time ideas of good design as expressed in pounds of metal, where a bridge, say, 25 years of age is renewed. He will see, frequently, that the weight of the new structure is four times that of the old one, though designed for not more than twice its load capacity. The excess represents partly insurance, partly a commutation of maintenance expense.

Useful data will be added to this phase of the subject when a railway man takes the trouble to cast up and publish the record of maintenance and repair expense on an old-time bridge which was finally condemned and renewed. Such a record will be certain to form a convincing argument in favor of "ample" design and against the practice of seeking the lightest possible solution of the stress-sheet.—Engineering News.

The Ultimate Economy of Permanent Concrete Paving

Contributed by C. A. P. Turner, of Minneapolis

As one travels in various parts of the country, and is taken about by automobile over country roads and macadam, concrete or tar macadam pavements in different sections of North America, one cannot help being impressed by the rapidly growing introduction of concrete in road building. The cost of a good concrete paving, six to seven inches thick, is little in excess of the cost of building a macadam road. The difference in wear renders the concrete far cheaper than the macadam because the concrete is made in the proper proportions, and suitable aggregate is used, and it does not disintegrate, although it does check and crack where the foundation is unstable. As compared with tar or asphalt macadam it is generally cheaper, and unless the latter is made of better materials and in a more satisfactory manner than ordinarily executed, it will disintegrate in the severe climate where the concrete remains uninjured.

A number of miles of tar macadam were put in a year ago on the Superior Boulevard, between the city of Minneapolis and Wayzetta. Last winter's frost has left this paving in very bad condition, while the concrete paving which occupies a section of this boulevard of eight or ten miles, is practically uninjured, with the exception of a few minor defects. A large section of this boulevard is new ground, some of it filled and some of it in cut. The frost has in a few sections split the concrete paving by motion, upheaval and movement of the foundation. This could have been remedied very readily by a small amount of metal reinforcing to tie the work together.

Expansion joints the writer noticed in driving over sections of this paving would seem to offer opportunity for improvement. Where the paving is cut through in a few places where it has been heaved by the frost, longitudinal reinforcement passing through this joint and filling this joint with asphalt mastic would apparently have remedied this difficulty. In making a joint in this manner it would be desirable to dip or heavily coat the ends of the rods projecting into one section, so that the flow of pitch or asphalt would permit the rod to work and still hold the slab at its proper elevation.

The writer's observations of the concrete laid in the city of Calgary were decidedly favorable. The paving company had secured good aggregate and executed their work very creditably.

In Sioux City, Iowa, there are many miles of excellent concrete paving put in at a cost far below that of other materials and at a cost little in excess of the temporary macadam paving. The reason why a good concrete slab paving can be put down on a county road at little expense in cost over macadam lies in the fact that the slab covers the foundation, prevents the water from working into it and undermining the slab to a large extent, and in this way renders the task of getting a good foundation for the road a much less expensive matter. This is because the slab will give service on a foundation that the macadam paving of crushed stone would not remain in shape upon, because the crushed stone would sink into a foundation which would very satisfactorily support a concrete slab. The cost of this foundation is high for a macadam pavement and low for a concrete road bed.

It may not be amiss to call attention pointedly to the necessity of securing a sound, hard stone as aggregate for the concrete and good clean sand, particularly in our northern climate. If the stone is such that it absorbs water very readily and is disintegrated thereafter by frost, the concrete will not be permanent, and will be affected by the frost and disintegrate more or less rapidly. Clay in the sand will prove a source of disintegration just as surely as improper stone for the aggregate.

In many sections the cost of lumber for bridge floors and frequent renewals is causing bridge commissioners to demand something more permanent in the way of a floor. The writer met this demand many years ago by applying a six-inch concrete slab well reinforced, covered with about a quarter-inch coat of hot pitch and sand. On country bridges this is found to work very well indeed, and to protect the concrete from abrasion and frost. The coating is comparatively inexpensive, and may be used advantageously as a top coating for county roads.

Mr. C. A. P. Turner.

While there is probably little that is new in this brief statement, the writer has seen much money wasted in macadam roads when a permanent concrete paving could have been put down at almost the same first cost, and would have been comparably cheaper to maintain. Every good piece of highway which is constructed, the maintenance of which will be inexpensive, is a distinct gain to the public at large. Calling attention to economic methods of accomplishing this result, and pointing out the best material for the purpose is a service which your journal may render.

Tools, pails, etc., that have become thickly coated with concrete can be cleaned by heating. A gasoline torch will aid in removing concrete from mixers and other large equipment.

The Construction and Maintenance of New York State Highways

A Review of the 1915 Report of the Advisory Board on Highways to the New York State Department of Efficiency and Economy

Specially Contributed by Arthur H. Blanchard, M. Can. Soc. C. E.[*]

DURING 1913 and 1914 Mr. Prevost Hubbard, Chemical Engineer in Charge of the Division of Roads and Pavements of the Institute of Industrial Research, Washington, and the writer, served as members of the Advisory Board of Highways of the New York State Department of Efficiency and Economy. Various problems, relative to the organization, administration, specifications, construction and maintenance of highways and related activities of the New York State Highway Department, were referred to this Board from time to time during the two years it was in office, by the Commissioner of Efficiency and Economy, the Hon. John H. Delaney. At the request of the Commissioner, the Board collated its numerous reports and presented the final report referred to in the title of this article. The following resume will deal primarily with problems of interest to engineers of construction and contractors. All recommendations embodied in the report were the result of exhaustive investigations of the headquarters office in Albany, the nine division offices of the Division offices of the Division Engineers and the design, construction and maintenance of highways throughout the State.

Professor Blanchard

Organization.—The important recommendations with reference to the organization of the New York State Highway Department are as follows:

That the Commissioner of Highways shall be a civil engineer having had responsible charge of the construction and maintenance of highways for at least five years and who is a full member or has fulfilled the requirements for the grade of full member of the American Society of Civil Engineers (M. Am. Soc. C. E.).

That the Commissioner of Highways shall appoint three Deputy Engineers and twelve Division Engineers, each of whom shall be a civil engineer having had responsible charge of the construction and maintenance of highways for at least three years, and who is a full member or who has fulfilled the requirements for the grade of full member of the American Society of Civil Engineers. Each of the Deputies shall have charge, under the direction of the Commissioner of Highways, of all work in four Divisions. The Division Engineers will report in the organization recommended to one of the Deputy Engineers. In each Division there shall be engineers in charge of counties reporting to the Division Engineer. Each Division Engineer shall in his Division and each County Engineer shall in his County have charge of the construction and maintenance of all state and county highways and all state work relating to town highways and bridges.

Comprehensive Advertisements Necessary to Secure Competition in Bidding.—A very general criticism may be made regarding the method of advertising contracts by the Highway Commission, which has invariably resulted in giving incomplete information to prospective bidders, and, in certain cases, misleading information. It is well known that the object of advertisements is to secure as comprehensive competition as practicable from responsible contractors, hence it follows that the information conveyed in advertisements should be such as not only to attract the attention of such bidders, but also give them such information as will enable them to decide whether or not it will be worth their while to submit bids. Concise advertisements containing the character of information referred to above in many cases saves considerable correspondence and tends to reduce the process of the submission of bids to the most economical and efficient basis from the standpoint of all interested parties. The essential data to be included in advertisements of highway work in New York could be arranged in the form of a table with the following headings: road number, division, county, town, name of highway, approximate length in miles, square yards of road or pavement, class of work, guarantee, date of completion.

Preliminary Investigations Necessary to Determine Suitable Types of Roads and Pavements.—Because of the following reasons the design of many state and county highways in New York State during 1913 and 1914 has been both inefficient and uneconomical.

First, the comparatively infinitesimal amount of investigation which has been considered necessary as preliminary to the design of a given highway.

Second, failure to utilize readily available data, such as traffic censi, statistics relative to motor traffic registration in incorporated villages and cities, routes of motor buses at present operated, population statiscics and data of a similar nature.

Seventh, failure to compile and make accessible for reference all important details which constitute the history of highways constructed.

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Fourth, the general meagreness of detailed knowledge of the many different materials on the market, and the varied methods in connection with which they may be used.

Fifth, belief by many highway officials and engineers in a panacea for the treatment of all classes of highways.

Sixth, a confusion of ideas on the part of many of the officials and engineers of the Highway Department as to the reasons for the success or failure of a given type of road or pavement.

Seventh, nonobservance of the relationship between the adaptability of various methods and materials, the variability in the cost of labor and materials, and the accessibility of new materials and machines.

Eighth, low ideals possessed by many of the engineers of the Highway Department as to the character of work which should be secured, which has resulted from past acceptance of inferior work and from lack of opportunity to become familiar with work of high grade in different parts of the State and other localities.

Width of Roadway.—In view of the fact that the unit width of traffic lines should be considered as nine or ten feet, and because the important trunk highways of New York are subjected to a rapidly developing traffic of motor trucks and motorbuses, it was recommended that the Commissioner of Highways should be given authority to construct many of the trunk highways with improved roadway surfaces of 20 feet in width instead of being limited to a maximum width of 16 feet.

Specifications.—Early in its work in 1913 the Board was directed to review the contracts and specifications of several lettings. As indicating the pitfalls which may prevail in specifications, the reasons for the recommendations to cancel many contracts are herewith cited: (1) materials specified distinctly different in type and grade from those advertised; (2) specifications which unnecessarily limited competition; (3) monopolistic specifications substituted for more open specifications which were indicated in the advertisement; (4) acceptance by the Highway Commission of bids on material other than specified; (5) bids requested on certain items which were so indefinite that an intelligent bid could not be made without knowledge ogtained from the Highway Department; (6) conflicting requirements in different parts of the same specifications; (7) different specifications for the same contract submitted to various bidders; (8) acceptance by the Highway Commission of altered bids; (9) duplication of work covered by different items upon which separate bids were requested; (10) inherently faulty specifications.

The revelation of the defects in the specifications resulted in a weeding out of certain inefficient employees of the Highway Department, the inauguration of more rigid supervision and more efficient methods pertaining to the draughting of modified specifications and finally an appreciation by the Highway Commission that the writing of an entirely new set of specifications was imperative if contractors were to be fairly treated and the interests of the State conserved.

During 1913 and 1914 the Board was requested to draft specifications for types of pavements suitable for use on state and county highways and to submit criticisms of specifications in current use by the Highway Department. The Board, recognizing the rapid increase in all classes of traffic on state and county highways and that the funds to be used were derived from the sale of fifty year bonds, recommended the use of cement concrete foundations for the four types of pavements to be used on properly designated state and county highways. Under the conditions existing in New York State in 1913 the Board recommended the use of the following types of pavement for the highways noted: bituminous concrete pavement with an aggregate of broken stone ranging from ⅛ to 1¼ ins. in dimensions; Topeka bituminous concrete pavement; brick pavement; and stone block pavement.
red pertaining to the relative merits of alternate type specifications and blanket specifications for bituminous materials. Although the chemists of the Highway

During the drafting of new specifications for the Highway Department considerable discussion occur-
Department recognized the value of separate specifications for refined coal tar and refined water gas tar, they were averse to the use of separate specifications covering the various types of asphalts secured from various sources and manufactured by several different processes. The Board pointed out that the individual tests required for specifications for individual materials may serve one or more of the following purposes: (1) they may directly indicate the suitability for a given use of the material specified; (2) they may serve as a means of identifying the source of a material or even the material itself; (3) they may serve to control uniformity in the preparation or manufacture of a material. It seemed apparent to the Board that tests used in selecting or specifying a material for a given use are most efficient when the test limits adopted specifically define a material and when such material has previously proved satisfactory for a particular purpose. It seems evident that the narrow test limits permitted in alternate type specifications allow the fulfilment of the essential requisites of specifications for bituminous materials in the most efficient manner.

Construction.—New York State built during 1913 and 1914 many miles of bituminous pavements constructed by the penetration method. The surfaces of many of these pavements showed waves or ruts soon after being opened to traffic. The Board believes that one of the inherent causes for these conditions is the light rolling required prior to the application of bituminous material. The usual method of rolling consisted in shaping up the broken stone course by one passage of the roller over the surface. It is impossible to secure inherent stability unless the broken stones of the course are thoroughly compacted and keyed together prior to the application of the bituminous material. During 1913 and 1914 many bituminous pavements of this type were poorly constructed due to the inefficient distribution of the bituminous material. The Highway Department specifications required the use of an approved distributor. Contractors, however, found it impracticable to secure a description of an "improved distributor." The Board, therefore, submitted the following specification:

> The pressure distributor employed shall be so designed and operated as to distribute the asphalt, cement or refined tar specified uniformly under a pressure of not less than twenty (20) pounds nor more than seventy-five (75) pounds per square inch in the amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the asphalt cement or refined tar and with an accurate pressure gauge so located as to be easily observed by the Engineer while walking beside the distributor. It shall be so operated that, at the termination of each run, the asphalt cement or refined tar will be at once shut off. It shall be so designed that the normal width of application shall be not less than

six (6) feet and so that it will be possible on either side of the machine to apply widths of not more than two (2) feet. The distributor shall be provided with wheels having tires each of which shall not be less than eighteen (18) inches in width, and allowed maximum pressure per square inch of tire being dependent upon the following relationship between the aforesaid pressure and the diameter of the wheel; for a two (2) foot diameter wheel, two hundred and fifty (250) pounds shall be the maximum pressure per linear inch of width of tire per wheel, an additional pressure of twenty (20) pounds per inch being allowed for each additional three (3) inches in diameter.

Inspection.—Especially during 1913 poor results due to inefficient inspection were apparent on every hand. Inspectors without previous training on the class of work of which they had responsible charge were employed in many instances. The 1913-1914 Highway Law was in part responsible for this condition as it required that inspectors of construction should be residents of the county in which the highway to be constructed was located. Such resident qualifications serve no useful purpose and tend to handicap efficient and economical work.

Maintenance.—Among the several details of maintenance of state and county highways which were covered in the Report may be mentioned the opinions of the Board relative to the use of "cold oil" and "hot oil" for surface treatments. Based on the conditions of use in New York, it was the conclusion of the Board that such products when used in the manner described were not suitable for economical maintenance and repair for the following reasons: (1) oils which meet these specifications require considerable time in which to set up, when used in the manner specified; (2) all petroleum products, while in a fluid state, act to a certain extent as lubricants, when used as specified; (3) it is therefore evident that more or less movement of the road surface will take place under traffic during the setting-up period; (4) the bituminous mats or carpets formed invariably become wavy and full of humps and ruts under heavy traffic; (5) due to the character of the resulting surface further maintenance is rendered difficult and costly; (6) prior to retreatment of roads thus repaired, it is often necessary to remove considerable portions of the bituminous mats with picks and shovels or with scarifiers.

Regulation of Motor Truck and Motorbus Traffic.—During the Board's investigations in 1913 and 1914 of the use of state and county highways by various classes of traffic, the Board became convinced that the laws of the State of New York do not adequately cover the regulation of motorbus and motor truck traffic nor does the Board believe that proper cognizance is taken of the development of the above classes of traffic in connection with the design of the highways of the State. It is evident that a consideration of motorbus and motor truck traffic, due to strains produced by heavy loads being carried over the highways at speeds of up to thirty miles an hour, will materially influence the selection of the type of pavement, the character of the foundation to be used and the determination of the requisite width of improved surface. It was found in 1914 that over 16,000 motor trucks had been registered by the Secretary of State and that over 100 motorbus routes were in operation throughout every part of the State and primarily operated on state and county highways. According to the records the motorbuses carried from five to forty passengers, had a horse power rating of from 20 to 75, and weighed loaded from 1½ to 8 tons. It is of interest also to note that the overall width of many of these buses was 90 inches or more. The Board included in its Report definite traffic regulations for the protection of the state highways, which covered loads, tire widths, speeds, etc., for horse-drawn vehicles, motor cars, motor trucks, motorbuses and traction engines.

The Use of Granite Block for Paving in Breslau, Germany

According to a recent report from U. S. Consul H. G. Seltzer, at Breslau, Germany, granite block, with cement mortar filling, is the paving material used on a greater part of the streets of Breslau, there being 2,059,153 sq. yds. of paving of this character out of a total of 2,483,972 sq. yds. of paved streets.

Mr. Seltzer calls attention to the permanence of all paving in Breslau and states that torn up streets are so rare as to be noteworthy, which, his report states, is remarkable considering the fact that the city lies only a few feet above high water and, there being no stratum of hard rock or impervious clay, the drainage difficulties present a considerable problem. On this account concrete foundations form a most important part in all paving operations.

Recently it became necessary to make repairs to the street railway tracks in a section of the city and an opportunity was afforded to observe the paving operations. The blocks were taken up, it being necessary to smash one block in order to provide a space in which to commence the work of tearing up. Each block as it was taken up was carefully cleaned and piled for resetting. The old sand bed was screened to remove all broken stone and mortar and was then replaced.

The granite blocks, which are dressed with the top smooth, were then set on the sand cushion, water was poured into the interstices and each block tramped solidly into place. The interstices were then filled with a thin cement mortar which, in hardening, made a solid and practically noiseless pavement. The blocks were set square between the rails and diagonally between the rails and the curb. The crown is such as to secure the best possible drainage, but owing to the general flatness of the streets there are often three or more sewer inlets in one city square.

Mr. Seltzer admits that the paving operations are conducted very slowly, as compared with American methods, owing to the attention to detail, but points to the lasting qualities and the practical elimination of repairs as an offset to any loss of time in doing the work. The work is done by contract, the city and the railway each paying a share of the cost. Definite specifications are prepared and the inspection is very rigid. On this account, according to the report, lawsuits for breach of contract or for inferior work are practically unknown.

Materials are sometimes furnished by the city and sometimes by contractors. There are large supplies of good paving granite in the Province of Breslau and large cement works are located at Oppeln, while there are quantities of good buildings and all along the Oder River, which flows through the city.

In addition to the yardage of granite block pavement noted above, the city has 129,288 sq. yds. of asphalt, 53,102 sq. yds. of wood block and 242,429 sq. yds. of streets paved with other materials. There are 32.54 miles of street railway owned by the municipality and 11.37 miles of privately owned lines.

Features of Bridge Design

ATTENTION is called to some important features of concrete bridge design by a paper recently read before the American Society of Civil Engineers. The paper, as stated by the authors, "is largely a plea for an arch consisting of two ribs, rather than one with a solid soffit; with narrow rather than wide ribs; and with deep ribs of I-section rather than of rectangular section. It is also especially a plea for the three-hinged as compared with the fixed and two-hinged arches."

The tendency of modern practice, as pointed out by The Engineering Record, is undoubtedly toward the arch with a number of ribs rather than that with a solid soffit. Examination of the plans of many of the later arches with several ribs, however, cannot but raise doubt in the minds of many engineers as to the lateral strength of these ribs. It has taken years of experience in the construction of steel bridges to evolve the present satisfactory rules for bracing compression chords in a sidewise direction. No compression member is properly reduced in length unless it is held by bracing as deep as the member and rigidly attached to it; moreover, such bracing must be capable of transferring all lateral forces to the abutments of the bridge. When proper lateral support is provided, much of the economy of ribs over the solid soffit disappears.

The use of the I-section, instead of the rectangular, has not the sanction of many engineers. The excessive cost of the forms and the difficulties of making them tight and of spading the surfaces, will in most cases offset the saving of concrete effected by the I-section. Before adopting the rib design in preference to the solid soffit arch for short and medium-length fixed spans, it should be remembered that the stresses due to rib shortening, temperature, and shrinkage are proportional to the moment of inertia of the cross-section.

The claims for the three-hinged arch as to ease of stress analysis and adaptability to location where the foundations are not absolutely unyielding, are generally acknowledged. But the claim that temperature, shrinkage, and rib shortening stresses are eliminated in the three-hinged arch is not fully realized, since there is a large frictional resistance at the hinges. From the standpoint of adequacy of design, therefore, hingeless arches, designed for temperature, rib shortening, and shrinkage stresses, cannot be said to be inferior to the three-hinged arch in the design of which these stresses are neglected.

The superior appearance of the arch without hinges is conceded by the authors, but no great weight is attached to it. Yet this superior appearance, due to the gradual increase in the thickness of the arch-ring from the crown of the skew-backs, is important wherever regard must be paid to architectural considerations.

In the comparisons of the cost of the several arches and their piers, too much weight is given to the saving of concrete, for it is a well-recognized fact that a few yards of concrete more or less do not affect the cost of a structure as much as the character of the work itself.

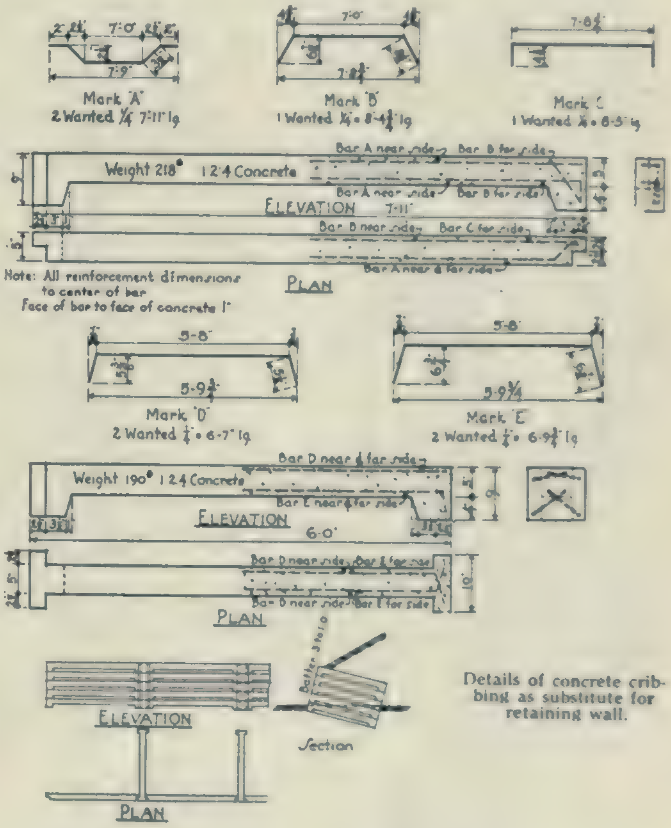
The pier recommended by the authors, consisting of two legs instead of the solid rectangle, will hardly be accepted with readiness by the majority of engineers. Piers with two legs and cross-struts would require more form work, fully as much excavation, and a higher grade of concrete for the same efficiency of structure as would the plain rectangular pier. It should not be forgotten, too, that the plain rectangular pier is generally of sufficient size to justify the use of cyclopean masonry, while the other type does not lend itself so well to the use of displacement stones.

There are other features that will undoubtedly receive consideration at the hands of engineers, but these brief comments will serve to indicate some of the lines along which there should be much valuable discussion.

Crib Substitute for Retaining Walls

CRIBBING of reinforced concrete, of the type illustrated in the accompanying detail drawing, is now used in some locations by the Chicago & Western Indiana Railroad as a substitute for the ordinary retaining wall, to hold the slope of banks. Mr. E. H. Lee, vice-president and chief engineer of the road, states that this cribbing has proved more economical than a retaining wall, and should be more durable than the common timber crib, which it imitates in form.

The faces members are about 8 feet long, and have the ends recessed to receive the T-heads of anchor members 6 feet long. Both face and anchor units are 5 by 5 in. in section, with ends 9 in. deep giving 4-in. vertical openings between units. It is thought, however, that in future work it will be an advantage to reduce the width of these openings. The concrete is a 1 : 2 : 4 mix, made with gravel or crushed stone that will pass a 1-in. ring. The face units have 0.054 cubic yard of concrete, and 32 feet 8 inches of ¼-in. square steel reinforcing bars; the anchor slabs have 0.047 cubic yard of concrete, and 26 feet 10 inches of steel bars. The weights are 218 lbs. and 190 lbs. respectively.



Details of concrete cribbing as substitute for retaining wall.

This cribbing was designed primarily as a substitute for retaining walls in certain locations where the height above ground would not exceed 8 to 10 feet. It is placed so as to give a heavy batter on the face (3 in. per ft.), in order that any tendency to slide may be resisted by the vertical rise of the members.

Among the advantages of this construction are: (1) A reduction of 75 to 80 per cent in cost as compared with retaining walls; (2) the possibility of easy adjustment in case the height needs to be changed; and (3) permanence as compared with timber cribbing.

Concrete Bridge Floors*

IN the Cleveland work, it was required that the railroad bridge floors be relatively noiseless and waterproof. In former years every effort has been put forth to build shallow floors so as to minimize the change of grade. Such floors have always permitted the muddy waters to seep through upon people passing below and have operated as drums in accentuating every sound from the passing trains. To overcome these defects the floors were made of I-beams and concrete slabs upon which tracks were laid and ballasted as upon the ground. Such a design requires a greater depth of floor, which means a greater change of grade, and more steel to carry the added weight of concrete. The bridge is therefore more expensive; but in cities where the noise is troublesome, the ballasted floor is a great improvement. Trains passing over such floors are noticed but little more than when passing solid ground.

A concrete floor slab can also be made reasonably watetight. The writer's first experience with concrete was on the Missouri in 1887-88. Later it was used a little on the New York state canals, and still later in bridge construction on the Nickel Plate. During this period many experiments had been made and papers written in which it was sought to demonstrate that concrete can be made practically impervious to water and also that it cannot. Much concrete had been built that was very porous and there sprung up numerous business enterprises for the manufacture and sale of waterproofing material. Both observation and experience indicated that watertightness could be secured by either with waterproofing. The requisite seemed to be that the material and workmanship should be the very best. If poor waterproofing were placed over poor concrete, the structure would leak. If the concrete were good, it would hold water, either with or without the waterproofing.

Especial efforts were made to avoid the entrance of water between the steel and concrete and at points of contraflexure and where cracks might develop from temperature changes. Bevel flashings of steel were riveted to the girder webs and malleable cast flashings were fitted around the stiffeners to cover and seal the edge of the concrete. This design was very successful. At points of contraflexure over curb supports and at Cedar Ave. over the centre columns, it was realized that cracks would develop and an attempt was made to forestall their appearance by the construction of joints. The joints were carefully provided with gutters and drainage pipes, and it was hoped that no trouble would be had with the water. The cracks were successfully forestalled, but the drainage was unsuccessful. The channels soon became clogged with cinders and the details of the steel work in the gross-girders did not leave room for a sufficient body of concrete, and in some instances the concrete proved imperfect. So, while the slabs proved generally tight, there has been some leakage at the points of contraflexure.

Much reliance had been placed on the use of direct labor and carefully selected foremen, but there came a great rush of work at a critical time and the floors suffered. In East Cleveland at a later date, it became necessary to build waterproof joints at the hinges of the arch bridges.

The concrete in the floor-slabs cost about $12 per cubic yard in place.

Now that the bridges are completed and have been two or more winters in service, the conclusions are as follows:

1. Concrete can be made watertight, under low heads, for all practical purposes.

2. The mixing, placing and ingredients of concrete are subject to such a great number and variety of defects that only the keenest attention will secure an impervious structure.

3. Contraflexure temperature changes and settlements will produce cracks.

4. It is best to forestall cracks with predetermined joints.

5. Joints may be sealed against water if well designed.

On the underside of the bridge floors the concrete is protected from locomotive blasts by cast-iron plates, ½ in. thick and 36 in. wide. They weigh 71 lbs. per lin. ft., and cost $5.23 per ft. in place.

Color Possibilities of Concrete

ONE of the strongest objections by architects to the employment of concrete for the external finish of enclosing walls is the unpleasing tint of the material as ordinarily prepared. A good deal of attention has been devoted to the surface treatment of concrete. White Portland cement has been used in many cases, but its cost is rather prohibitive for average work. Coloring matter, mixed with the sand before the addition of cement and water, is employed by various firms engaged in the production of concrete stone. The most satisfactory way, however, of obtaining a pleasing color and texture in concrete surfaces is to select aggregates of appropriate tint, and to clean away the cement so as to expose the stone. A surface so produced will not deteriorate and is exempt from the disadvantages attaching to rendered and to artificially colored surfaces. The film of cement coating the aggregate can be removed by brushing while still green, afterwards treating the work with a weak solution of hydrochloric acid, and washing away all traces of acid. Concrete surfaces may also be tooled in the same way as natural stone, the best results being obtained by mixing the concrete to be so worked with aggregate of small gauge. The material must be thoroughly hard before tooling, otherwise sharp edges and surfaces of fine texture cannot be obtained. By the judicious combination of tooled surfaces and details with surfaces obtained by the exposure of colored aggregates, the architect will be able to secure results of very pleasing character, and which possess the merit of exhibiting the materials actually employed throughout the construction.

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* Abstract from The Elimination of Grade Crossings on the N. Y. & St. L. R. R. in Cleveland, Ohio, by A. J. Himes. Bulletin No. 160, A. R. E. A.

Developments in the Manufacture and Use of Brick

Specially contributed by W. D. Alsip*

IN the very early ages of mankind, burned clay was discovered and was used to house and serve man. It is intended to go into the history of the development of the craft of brick-making. We will take burned clay ware that we find on the present market for construction purposes, and see if we can eradicate some of the abuses and create a clearer apprehension of some of the causes and effects that tend to curtail the use of this best of all fireproof material.

Under the heading Brick we have a great variety, which I will divide as follows: 1st, common building brick; 2nd, face brick; 3rd, paving brick; 4th, fire brick.

Common brick are made by several processes, viz., A—slop or water-slipped soft mud brick; B—sand mould, soft mud brick; C—"Auger," "Plunger machine," wire cut, or stiff mud brick; D—dry pressed brick; E—hammer machine, semi-dry clay brick.

(A) Slop or water-slipped brick are only manufactured in a small way, and therefore need not be considered.

(B) Sand mould brick are manufactured by hand, either by a striker or moulder. The clay is prepared (tempered with plenty of water) and delivered on a table. The striker cuts a wedge-shaped slice off, large enough to fill a little more than the mould, and casts it into the mould with force enough to fill the corners and edges. The clay must strike the bottom of the mould first, then spread and fill from bottom to top to avoid wiping off the sand which has been deposited on the mould before coming to the striker, otherwise it will not be possible to get the brick out of the mould, which usually holds six brick. After the moulds have been filled, the caps or clauds are struck off with a strike-stick, which is taken from a water trough and thrown back to be added to the next mould or brick. The sand mould brick are also manufactured "by hand" by a moulder. This process is used when clay is fat or sticky and does not leave the mould freely. The moulder cuts off enough clay to equal about a brick and a half, and rolls it in sand forming a pointed claud, which is cast the same as described above, except that the cups are cut off by a wire bow. Sand mould brick to-day are nearly all machine-made, and they are an improvement on the hand-made product. Clay used is usually taken from the surface deposits. The brick when burned weigh from four to four and one-half pounds, and are of a more or less porous nature. Canadian standard brick weigh less than most of the American manufacture, owing to the panel or frog which is moulded into the flat or bottom side of the brick. Sewer, face, common and fire brick are manufactured by this process.

(C) Auger machine, or wire cut brick are manufactured from plastic clay with just enough moisture to cause the clay to work into shape. Some machines mould the clay stiff enough to pack or pile eight high without losing their shape. Shales and surface clay are used. The fat clays take much less power. The brick are very dense, and weigh from five to six pounds. Paving, sewer, face and common building brick are manufactured by this process.

(D) Dry pressed brick are made of surface and shale clays. The clay must usually be worked and dried and then ground into a fine state. This ground clay or dust contains about seven ounces of water per brick, and is fed into the machine, where it is subjected to enormous pressure. In some districts common building brick are manufactured by this process.

(E) Hammer machine brick are made by a machine that tamps the clay into the mould, in much the same manner as a quartz stamp mill. These machines are only used, I believe, in the St. Louis, Mo., district, and doubtless they will soon disappear.

The Uses of Brick

We now come to the uses of brick. Most makes of brick have sufficient strength to carry all the load required of them in ordinary building. Your local engineer will determine and pass on all questions of this nature. There is little room to doubt the strength of a brick which has been built into a twelve or fifteen-storey skyscraper, and found not wanting. Such a brick will or should be accepted for stores, warehouses, dwellings and structures requiring less pressure. Where concentrated loads are to be carried on piers, or at ends of steel beams, clinker brick or paving brick should be used. Brick laid up in lime mortar make a good wall, but when laid in mortar cement, a wall is produced that is nearly indestructible and will stand for generations. In cold climates, such as prevail in Western Canada, the architect and builder must keep in mind the power of the various kinds of brick to resist cold. A porous body will absorb and conduct much less cold or heat than a solid or dense body; therefore in selecting the brick for building a wall for a dwelling where the walls are only nine inches and thirteen inches thick, a porous brick will make a much warmer house. The same applies to blocks, stores and apartments, where steel or reinforced concrete are used. The curtain walls are light and therefore must be built with brick that will be as nearly non-conductive as possible. The old-fashioned stone house, the new concrete house, and the wall built of vitrified street pavers, are all the best cold conductors it is possible to select, and if these materials must be adopted, then the best backing or lining should be used to insure a warm building. A stone or concrete wall should be lined on the inside with porous hollow brick, to which at least twenty-five per cent. sawdust has been added, and burned out, producing a fireproof body much like cork. The plastering may be applied directly on these brick, and no bad effects will be produced in the coldest weather. Walls finished with water-colored kalsomine have stood season after season in kitchens and laundries, when this method of construction has been adopted.

The old method of furring or strapping the walls, and lath and plastering, is not as effective, as it is found nearly impossible to keep the air in the room from coming into contact with the wall, and forming frost or dampness, which in turn forms mould or must, which when dried out forms dust, which permeates the rooms, and is the cause of much sickness. Many cases of hay fever, tuberculosis, rheumatism and kindred ailments can be traced to damp houses. Damp, cold houses are not caused—as many believe—by the moisture passing through the walls, but by the walls becoming cold or hot, and then having hot or cold air come in contact with them, causing the moisture in the air to condense and deposit drops of water, much as a glass pitcher will do when filled with cold water on a humid day. In building a block, warehouse, or home, as much and more care should be exercised in selecting the brick for the different parts of the work as is used in selecting material for any other part of the building.

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* President Alsip Brick, Tile and Lumber Company.

A freight depot or warehouse might require a vitrified paving brick to stand the hard knocks, and keep clean of soot and dirt in a down-town district. A stable would have to be built better and with more care—as to the ability of the structure to keep dry—than perhaps any other building. The large amount of moisture thrown off by a stable-full of horses, just in from heavy work, will condense on the walls of a concrete, stone or solid brick wall, but when lined up with porous hollow brick or tile, this is almost—if not entirely—overcome. For a dwelling-house a faced brick, more or less porous, that will keep clean and ripen in appearance by age, is preferable to a more dense or waterproof brick, and when backed up with a porous hollow brick or block it will produce a dry, warm house that will save fuel, do away with draughts, and be a joy to the owner all his life. Speaking of draughts—often in a house where windows and doors are airtight there is a constant draught in cold weather, caused by the heated air of the room coming in contact with the cold solid wall. The cool air settles to the floor and is drawn towards it, causing a draught that is very disagreeable and apt to cause colds and ill-health to the occupants.

In conclusion, this slogan should be adopted by all builders: "The best is not too good."

What Are Porous Bricks?

THE definition of porosity with respect to building bricks has recently been the subject of some discussion, and the following observations, by a correspondent of our London contemporary, The Building World, is of interest.

With the exception of engineering bricks, all ordinary building bricks are somewhat porous; that is to say, they will absorb water, though the amount so retained in the pores varies greatly with different bricks.

In the south of England the average amount of water absorbed by bricks during complete immersion is about 12 per cent. of the weight of the brick. North of the Trent and in Wales somewhat denser bricks are usual, and the average water absorption is seldom over 8 per cent. of the weight of the brick.

Bricks made by the semi-dry process—that is, by compressing the clay in the form of a damp dust, absorb only about 5 per cent. of water, though they vary greatly in this respect. Engineering bricks absorb less than 1 per cent. of their weight of water. For all ordinary purposes, therefore, it is not desirable to designate bricks which absorb less than 15 per cent. of their weight of water, on immersion, as particularly porous.

During the last few years the use of hollow blocks and hollow bricks has extended rapidly. These are much lighter than solid bricks and effect an important saving in railway carriage, but they must be distinguished from porous bricks. The weight alone is not a sufficient guide, as hollow bricks are now made which are indistinguishable in appearance from solid bricks. When cut or broken their hollowness is easily seen. On the Continent, porous bricks are defined as having a weight which is notably less than common bricks, but this definition will have to be abandoned now that hollow bricks are made in large numbers.

The large, hollow blocks used in fireproof floors, etc., are usually made of a highly porous material. This not only reduces the cost of carriage and the weight of material in the structure, but it facilitates manufacture of blocks accurate in shape and free from twists.

A simple test for porosity consists in holding the tongue lightly in contact with a brick. If a distinct suction is felt the brick will be very porous; if no appreciable suction is apparent, but the moisture rapidly dries from the surface, the brick is but slightly porous. Engineering and non-porous bricks will not absorb water, even if poured on to them.

A much better test consists in weighing a dry brick, immersing it in water for twenty-four hours, wiping it dry with a few rapid strokes of a clean cloth, and then re-weighing it. The weight of water absorbed will indicate the porosity. It is true that the water may not penetrate all the pores, but the test is sufficiently accurate for most purposes.

The bricks used in architecture should be moderately porous, as, otherwise, water condenses from the air, and the resultant water collects in drops on the inside of the walls, spoiling the wall paper and giving the impression that the building is damp. If the pores are sufficiently minute the bricks may be as highly porous as possible. The more porous they are the better will the walls "breathe." Bricks with large, coarse pores should be avoided, as they admit rain water too easily, and walls in which they are used often remain permanently damp.

The Dominion Steel Corporation production for the month of June, with comparisons, was as follows:

	June, 1915. Tons.	June, 1914. Tons.
Pig iron	22,552	21,111
Steel ingots	28,680	26,620
Rails	13,044	16,998
Rods	6,435	1,981
Bars	797	2,347
Wire and wire products	3,167	1,541
Coal mined	481,820	485,449

The Pan-American Road Congress is to convene on Monday, September 13th, at the Municipal Auditorium, Oakland, Cal. Many leading authorities on road work and paving have accepted invitations to the meeting, among these being Mr. W. A. McLean, Chief Engineer of the Ontario Highway Commission.

Transmission-Line Towers: Foundations and Erection

At the recent convention of the American Institute of Electrical Engineers several of the papers dealt with the practice of power companies in providing adequate supports for transmission line steel towers and in erecting the structure.

Toronto Power Company

Notes on the old and new 60,000-volt lines from Niagara Falls to Toronto were contributed by F. C. Connery, Superintednent of Transmission Lines of the Toronto Power Company. About one hundred sets of the type shown in Fig. 3 were dug up after seven years' service. In no case was the galvanizing deteriorated, and the impregnated wood blocks were in a fair state of preservation. These were used with standard 40-ft. two-circuit towers. With some 53-ft. double-circuit towers the wood blocks were omitted. Six such towers were erected in black muck, which gave no resistance with borings to 40 ft. Plank sheathing was driven around each leg location, the muck dug out and a floating foundation of impregnated 2-in. plank put down at 6 ft. below the surface. The stubs were set in concrete about 1 yd. to a footing. There has been no settlement or change of alignment in a year.

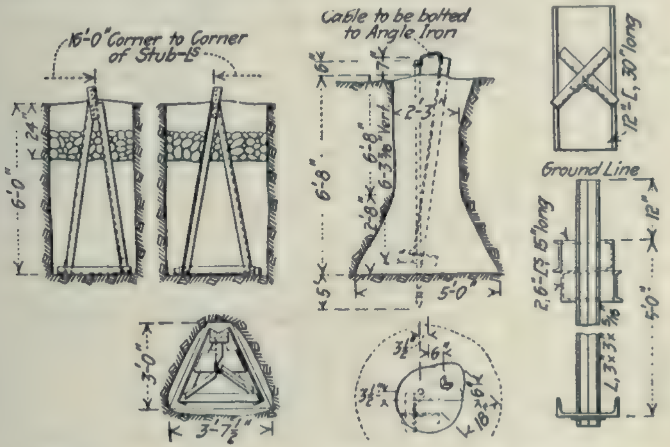

Fig. 1.—Old tower foundations, Pensylvania Water and Power Company.

Stubs were bolted to a steel template lined up on centre line stakes and levelled with a carpenter's level. One man backfilled, while two tamped, water being used when available to settle the earth.

A type of very narrow-base latticed towers or poles was employed on a 6 x 6 x 6 ft. 1:3:5 concrete base with twelve 1¼-in. anchor bolts. The foundations for some of these poles varied beyond a minimum depth of 6 ft.; then they were erected on 12 inches of concrete and the excavation filled with concrete around the pole.

New tower footings are now being designed as follows: (1) modified screw guy anchor for light structures, (2) a screw guy anchor with a large footplate on a shallow concrete slab, (3) a screw pile with top plate for the tower foot plate, and (4) threaded wood pile. It has been found unnecessary to drive a pile to refusal to get a good tower footing, there being sufficient skin friction in the upper layers of soil.

J. A. Walls, Chief Engineer of the Pennsylvania Water & Power Company, reported that, on the line from Holtwood (or McCall Ferry) to Lancaster, bell-bottomed concrete foundations had been used, and also on the anchor towers of the Holtwood-Baltimore line. Buried steel tripod stubs were used for the intermediate towers of the latter line. Lifting tests were made on steel single-leg and tripod stubs (the former with top and bottom fins) and the bell-bottomed concrete supports. The single-leg stub pulled out at about 23,000 lbs., the tripod type at 32,000 lbs. and the concrete was untouched at 70,000 lbs., the capacity of the testing outfit. These supports are shown in Fig. 1.

For the second Holtwood-Baltimore line (a short and important trunk of very heavy construction) it was decided to use concrete stubs, and four types were investigated—(1) bell-bottomed without forms, (2) bell-bottomed with steel forms, (3) bell-bottomed with wood forms, and (4) truncated pyramids with wood forms. They were more or less satisfactory, in the order named, and the first type (Fig. 2) was selected.

Post holes 3 to 4 feet deep and 16 inches in diameter were dug and the bell scooped out with a spoon. If the soil for any hole was too hard for this, a half-stick of 40 per cent. dynamite was first shot in a small hole punched down about 2 feet. In rock two or three shots generally opened an entire hole. Ordinarily, one man dug two or three holes a day. One man was put on each hole and a foreman had charge of three or four gangs. Holes were laid out by rods and cord from reference stakes, only about five minutes being required for a base. Attempts were made to shoot out the holes in ordinary soil with a full stick of 60 per cent. dynamite and two half sticks of 40 per cent., but this was not generally successful.

The concrete mix varied from 1:2:4 to 1:3:5. Sand and ¾-in. stone were shipped in carload lots to various stations along the line and distributed by four-mule teams—1.5 yd. of stone and 3.4 yd. of sand being dumped at each tower site. These amounts were increased 50 per cent at each fifth tower. Cement was stored in farmers' barns—100 to 200 bags to a place. Mixing and pouring for one tower required about three-quarters of an hour, while moving and setting up required about an hour. A 2.5 cu. ft. hand mixer on two wheels was used. It weighed 1,000 lbs. with platform. A portable runway elevated the mixer enough to let a wheelbarrow go under the chute. Water was hauled in a two-horse steel tank, which was filled with a 4-in. boat pump from creeks. It would have been better to use a lighter wagon with a small suction pump and 15 feet of hose.

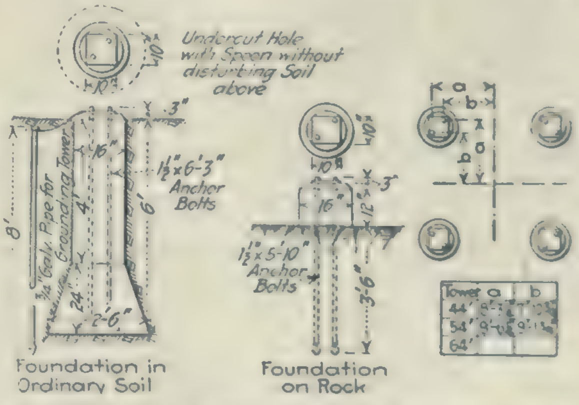

Fig. 2.—New footing. Pensylvania Water and Power Company.

The smallest number of men needed in concreting was nine—under one foreman. Two or three more men were often used to advantage, especially in moving. One to three teams were employed, depending on the length of haul for water and cement. Water in the anchor holes was pumped out. A short length of 6 in. sheet-iron pipe for depositing concrete would have been better where holes filled fast.

The tower bed plates were not on hand at first and dummy plates were tried, but did not give a good seating for the plates. Some piers were left 8 ins. below grade and finished with the plates later. After the bed plates were on hand the concrete was poured to within 1 inch of the top of the anchor bolts and the plates hammered down on the soft concrete to the grade given by the instruments.

The actual cost per tower averaged:

Hauling	$13.20
Grading	2.27
Digging	4.92
Materials and concreting	28.50
Total	$48.89

The steel was assembled on the ground in a horizontal position and towers were erected by a rigging gang of 11 tower legs to prevent damaging the footings. A 3-ton motor truck is the best motive power for raising the towers and for transporting equipment. Nine men with a truck will raise and fasten down an average of nine towers in a 9-hour day.

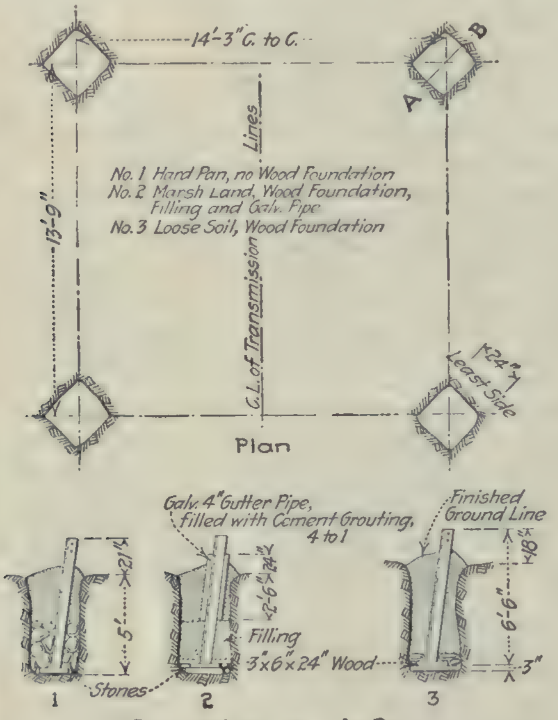
14'-3" C. to C.
13'-9"
A
B
Lines
C.L. of Transmission
No. 1 Hard Pan, no Wood Foundation
No. 2 Marsh Land, Wood Foundation, Filling and Galv. Pipe
No. 3 Loose Soil, Wood Foundation
24"
Least Side
Plan
Galv. 4" Gutter Pipe, filled with Cement Grouting, 4 to 1
Finished Ground Line
21½"
5'
24"
2'-6"
Filling
3"x6"x24" Wood
18"
6'-6"
3"
Stones
1
2
3
Sections A-B

Fig. 3.—Foundations for 40-ft. towers. Toronto Power Company.

Speaking at the Junior Institution of Engineers on "Bridge Construction in Bolivia," Mr. C. W. Glover, jun., said that in the districts through which the railways pass the only negotiable route is very often one along the banks of the rivers. Thus necessitates frequent crossings over the many tributaries, which during the floods, bring down large quantities of mud, loose rock, and trees, owing to the resulting accumulation the mouth of the tributary spreads out into a fan-shaped mudbank, or "mazamorra," from 25 to 33 feet deep. When properly drained and sun-dried, these "mazamorras" are quite hard, and apparently quite firm; but a 10 minutes' rain-storm is often quite sufficient to convert each into a moving quagmire, which will carry away any bridges constructed upon it in the dry season. The accumulation of debris often completely buries bridges constructed to span the mazamorras. Under-bridges have in many cases been substituted for over-bridges, but have proved inadequate to cope with the enormous loads involved.

An Old Stone Staircase

WHILST engaged in carrying out structural alterations at an old hotel at Poole, England, the workmen discovered what is considered to be a secret stone spiral staircase associated with the smuggling days. The premises date back two or three hundred years. The staircase had been ingeniously constructed in the wall, with a stout beam on the outside. Entrance is presumed to have been made through a cupboard placed on the right-hand side, and from the ground floor to the first floor there are niches in the wall for the feet, above being a series of steps. In the side of the wall about four feet from the ground is a square framed cavity, through which contraband goods were passed.

There is also an old-fashioned door containing old lights, upon the glass in one of which has been scratched "William Milner, Junior, November 8th, 1783, Custom House, Poole."

Removing Iron Rust Stains from Stucco

IN the case of a stucco house the iron work in various places rusted and discolored the stucco. The owner wanted to know how to remove this rust from the stucco and wrote the Concrete-Cement Age in regard to it.

The question was discussed by two experts, one of whom offered the following suggestions:

"If these stains are purely of surface discoloration, it should be possible to remove them with a wire brush; if, on the contrary, the entire thickness of the stucco has become stained, it will be necessary to put on a cement wash to cover the spots, or to cut out the stained portions and jut on new stucco."

The other expert suggested this procedure:

"A solution of hydrochlorite acid and stannous acid will remove iron rust from concrete, and will not injure the concrete if the treatment is administered rapidly and the face immediately washed with clean water. The solution mentioned has an affinity for carbonate of lime, consequently it should not be used where hydrated lime has been incorporated in the mixture. Rough finished cement stucco should be treated by spraying with the above solution as the result will be more thorough and the work more rapid than by the use of a brush. Satisfactory results may also be obtained by diluting one of the commercial cement paints until it is thin enough to use in a spray pump, and painting the surface of the stucco by spraying the diluted paint upon it."

According to the statement of General Bertram, six thousand artisans are employed in Canada, drawing weekly wages of $1,000,000 in 247 factories, manufacturing shells for the war arena. Orders for 9,000,000 shells have been placed here by the shell committee and for 8,100,000 cartridge cases, fuses, primers, and friction tubes. For these contracts orders have been placed for 170,000 tons of steel, 30,000 tons of lead and several thousand tons of other material. Canada will be shortly turning out 50,000 shells a day.

A Discussion of Mechanical Traction for Municipal Work*

By Ernest J. Elford†

It is important that the municipal engineer should keep in close touch with improvements in methods, materials, and appliances, among the more important of which last-named mechanically-propelled vehicles for use on highways occupy one of the most foremost positions. They are of great variety, being driven by steam, petrol or petroleum, and—more recently—by electricity. Some are complete carryings units, whilst others are capable of hauling only other vehicles carrying the load. Each type has points of advantage and disadvantage as compared with the others, according to the conditions under which it is required to work. It should be borne in mind, however, that it is not under all conditions that mechanical traction can successfully compete with horses. From the financial point of view, perhaps, the most important factor is rapid loading and discharging. Some appreciable delay at each end of a journey with horse-drawn vehicles is unavoidable, and, in fact, desirable, but loss of time with motors makes all the difference between profit and loss. A motor unit is much more expensive in first cost and running cost than a horse unit, and it can only be made to pay by carrying much larger loads at a much quicker rate. It seldom pays to buy second-hand motor vehicles, as it is during the first few years of their life, when they can constantly be kept at work, that they are most profitable. Where motors are used it is desirable to employ as many as can be kept constantly at work, as under these conditions five, six or more can be used to greater advantage and more profitably than one or two. For instance, large loading and unloading gangs can be employed, and this means shorter terminal delays. The cost and delay of repairs can also be much reduced when there is sufficient motor or other work to justify the provision of a workshop and staff, so that repairs can be done promptly at the depot. In addition, where a number of steam vehicles are employed, the boiler cleaning and overhauling can be done at night by a separate gang, who can also light the fires and get up steam ready for the drivers in the morning.

Steam-driven Vehicles.—Their chief advantages lie in their comparative simplicity, substantial construction, flexibility, and large reserve of power. Any man of ordinary intelligence who has been used to driving a steam roller or engine can soon become capable of driving a steam vehicle, and, as a rule, the results of any inexperience or carelessness are not so serious as would be the case with a petrol vehicle. If well-designed, built, and cared for, a steam vehicle will last many years. The reserve of power of a steam engine is often of great value when the vehicle is operating over bad roads, or when it is necessary temporarily to overload, while, except in the event of serious damage, a steam vehicle is seldom entirely incapacitated, so that it can generally be driven home. It can, too, be more easily adapted as a stationary engine for driving plant. Another factor in favor of steam vehicles is their low running cost. As to disadvantages, the boiler, coal supply, etc., add considerably to the weight; they are not available at short notice, as steam cannot be raised in less than forty-five minutes; washing out and overhaul of the boiler usually takes about six hours each week, and where the water is not suitable the boiler is likely to give trouble by leaking tubes, priming, etc.

Petrol Vehicles.—The author has used both steam and petrol vans for street watering, and is of opinion that steam vans are better for this purpose where they are convertible for general haulage purposes, but that petrol motors are better where they are used only for street watering. The latter are always available for instant use, cover a great length of road in a given time, and are quieter. The majority of motor vehicles used for municipal work are convertible. In many cases they are used during the summer months for street watering and during the remainder of the year for general cartage. For the former purpose it is the author's practice to use cylindrical tanks for quantities up to 600 gallons and rectangular tanks for larger quantities. The smaller tanks are provided with petrol motors, which are used almost entirely for street watering and sewer flushing. The larger tanks generally have a capacity of about 1,000 gallons and are used with five-ton steam motors during the summer only. The author is a firm believer in rubber tires, except for vehicles which use bad roads, where the wear and tear of this material is likely to be abnormal. He is also of the opinion that it pays rather to over-tire than to under-tire, and it is his practice to specify for the wheels of a five-ton steam vehicle the largest rubber tires made The rubber tires of some of the vehicles under his control are maintained under contract at a charge of 1¾d. per car-mile per set of six tires—twin tires on driving wheels. The cost of this arrangement compares satisfactorily with the purchase of tires outright. The author has not had experience of any petroleum carburettor suitable for petrol vans, but has found this fuel quite satisfactory for motor rollers, which are comparatively slow-moving.

Electric Vehicles.—These are likely to be of advantage for the collection and cartage of house refuse and other municipal work. The Southend corporation has for some months been running an electric omnibus in service with petrol omnibuses, and, on a test of fourteen double journeys, the electric vehicle covered 89 miles at an average speed of nearly 9 miles per hour, including stops. The route was undulating, with sharp gradients in places, the omnibus was well loaded on all journeys, and the current consumption was at the rate of 1·56 units per mile. From experience up to date it appears that an electric omnibus will cost from 10 per cent. to 15 per cent. less per omnibus mile than a petrol omnibus. One great advantage of the electric drive is that a skilled driver is not required. For the collection of house refuse the Edison Accumulator Company suggests 3-ton electric vans, having a capacity of 8 cubic yards, and 2-ton vans having a capacity of 8 cubic yards. The speed of the 3-ton vehicle fully loaded is given as 8 to 9 miles and of tre 2-ton as 10 miles. The weighing and tipping at the destructor is estimated to occupy 5 or 6 minutes. The larger vehicles are proposed for the longer and the smaller for the shorter distances. Each size vehicle is estimated to collect and deliver to the destructor from 9 to 9½ tons of refuse per day. The paper concludes with some valuable figures giving estimated cost of maintaining and running 2-ton and 3-ton Edison accumulator vans respectively, and average day's cost of street watering, gulley and street flushing, etc., (a) by steam vehicles, provided with convertible bodies, and (b) by petrol vehicles, adapted for street watering and sewer flushing only.

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*Paper presented at the annual meeting of the Institution of Civil Engineers.

†Borough Engineer, Southend-on-Sea, England.

The Training and Work of the Engineer*

By H. T Wakeham

THE work of the engineer covers an extremely wide field, the constant extension of which renders almost every department of physical science a necessary and fundamental part of a course of education, founded upon a proper basis of mathematics, for those entering the profession.

To a theoretical preparation there must, before a man can be said to be thoroughly equipped for his work, be added a sound practical training in the particular branch of the profession he chooses to follow, or wherein to specialize. It is a "long, long way" to final success, but in this way only can an engineer hope to succeed in his work. Such a training will enable him to bring to bear that thought, concentration and economical adaptation so necessary for that inventiveness and accommodation to circumstances which many members of this institution have so skillfully displayed in the past, and which have been the means of helping them to the high positions they hold in the profession, which positions they have so hardly won by efficient work and constant application. The measure of a man's theoretical knowledge is proved by his success before a board of examiners, but practical experience can only be obtained in the workshop and on works of construction, where a man will, if at all of an observant nature, quickly see how and where his theoretical ideas require modifications to meet actual constructional conditions. While I think it is absolute necessary for a sound theoretical training to be afforded to beginners in the profession, I must confess that I have a sneaking liking for the man who possesses ideas prompted by practical work.

If I may be allowed to address a few words to the younger brethen, I would say, select as models two or three of the more successful practitioners of the institution and follow their examples. By so doing success will probably ensue. "Rome was not built in a day"; neither will the higher positions in the municipal and county engineering world be won in a day's work. Such positions are, however, always open to those who care to take the trouble—as our American friends would say—"to get there."

I would also impress upon the younger members the necessity for visiting works during the preparation of materials and during the actual constructional operations. The measure of a man's knowledge cannot always be judged from the length of his experience. For instance, two men may go through exactly the same job, and at the end one of the two may show a much greater knowledge of both its principles and details than the other. This arises from the degree of observation exercised by both men. Where one fails in this, another succeeds. Much can therefore be gained by observation, and the more visits that are made to works in progress the more knowledge will be gained by the observant student.

While offering a word of encouragement to those juniors who have already started their professional careers, it would not perhaps be out of place if I also tendered a few remarks on the advantages of the engineering profession. With the world power of England—such as is held by no other nation—its vast possessions, its interest and influences, there is an almost unlimited field for a display of energy by men who possess constructive ability and capacity. In comparison with other professions, engineering offers many opportunities for men to gain, not only a good living, but to rise to positions of eminence in life—positions of which there are none of more utility.

The most successful engineers have been those who have been decisive and courageous in their views, and who have possessed tact and capacity for hard work. In addition to these essentials, a constitutional condition sufficient to withstand all kinds of weather and physical and mental strain, form necessary attributes if a man is to succeed.

With regard to the scholastic work of a boy desirous of entering the profession, I personally think that such a boy, until he attains the age of sixteen or seventeen years, should be well grounded in mathematics, mechanics, physics, chemistry and geometrical drawing. A boy at the age of seventeen who can pass an examination equal to the standard of the matriculation examination of the University of London should (provided he continues evening classes during his pupilage) very quickly make headway, given the attainments and attributes I have already referred to.

Should it be within the power of the parents to take a boy from school, say at the age of sixteen, and send him direct to an engineering college to take a science degree in engineering, or to an engineering school provided with laboratories and workshops, it would add greatly to his advantage. He would in this way combine theoretical study with practice of the kind he would obtain in an engineering works. This knowledge should fit the boy for the work he would afterwards be called upon to perform in connection with his pupilage in a manner satisfactory to himself, and would remove, to a great extent, the feeling of hopelessness which often assails some pupils when asked to proceed with work which to them appears both abstruse and difficult, but which in reality presents no difficulty to those who have been sufficiently well grounded in their preliminary studies.

On the other hand, young men who have received a college training must not forget that there are many things which they cannot have learnt during their college course, and that it will take years of practical experience to complete their engineering education, and enable them to take up responsible positions.

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*Abstract of presidential address before the Institution of Municipal and County Engineers.

An artistic draughtsman who lacks that constructional knowledge which will enable him to prepare a sound specification explanatory of his work will not be able to keep pace in the world's competition with the man who can prepare a fairly good drawing with a specification fully explanatory of the practical work he desires should be carried out.

The work of the engineer is fast becoming more and more technical and important, and with the march of time and competition it appears to me that the best-trained men will have the greater chance of success, not only in the particular branch practised by members of this institution, but also in all other branches.

Going briefly into the history of engineering, we find that one of the first works of magnitude was carried out by those of whom we speak as "the ancients." It was no less a work than the construction of the canal uniting the Red Sea with the Nile. That canal, we are told by Pliny, was originated and begun by Leostris. Others say that the work was carried out by Necos, and finished by Darius I., 525 B.C. To whomsover the work may be properly assigned, its existence shows that engineers were actively at work many centuries ago.

As one of the first engineering works of which we have an authentic record was in connection with the Nile, it may not be misplaced if I recall the fact that within recent years a stupendous engineering feat, known as the Nile dam, was carried out across the same river, with which work a present eminent member of this institution was conspicuously connected.

Previously to the eighteenth century there were many celebrated undertakings carried out by engineers, among them being the dome of St. Mary's, Florence, by Brunelleschi, and the dome of St. Peter's, Rome, by Michael Angelo. Other great engineers who practised centuries ago were San Michalin, the supposed inventor of the military bastion system, and Pagan and Vauban, who were both celebrated in their different branches of work.

During the eighteenth and nineteenth centuries, and also in our own time, there have been many successful engineering achievements of considerable magnitude connected with which, during the more advanced period, both past and present members of this institution were engaged. In regard to some of the achievements for which members have been responsible one may refer to large extensions of the main drainage works of the Metropolis, the main drainage works of Frankfort-on-the-Main, the supply of water from Wales to Liverpool, the supply of water from Wales to Birmingham, and the additional supplies of water to London. The Manchester Ship Canal, the Forth Bridge, the Tay Bridge, the Tower Bridge, the Simplon Tunnel, the Severn Tunnel, the Mersey tunnels and the Thames tunnels, and many other works, comprising vast undertakings and expenditures, have also been carried out within comparatively recent times.

The Victorian era saw many of the large trunk railways and canals of this country brought into operation, while it appears but yesterday that the Great Central Railway and several of the large metropolitan tube railways were completed and opened to traffic. The original construction of railways in this country gave a great impetus to the work of the engineer. Some of the undertakings which made such men as Stephenson, Telford, Brunel and others famous are the bridge over the Tyne, the bridge across the Menai Straits, and the tubular bridge at Saltash, which monuments appeal to us to-day.

Those members who are acquainted with the works I have enumerated may with pride arrogate to themselves the satisfaction of being connected with a profession which has produced men of the capacity of those who carried out the works to which I have referred.

Causes of Metal Bridge Corrosion

DISCUSSING, before the Engineers' Society of Western Pennsylvania, the protection of metal structures, Frederic H. Fay, of Fay, Spofford, & Thorndike, consulting engineers, Boston, pointed out that the corrosion of metal bridges is due principally to one or more of four causes. These are exposure to locomotive gases; exposure to sea water; exposure to surface water leaking through bridge floors; overstress of the metal, by which corrosion has been hastened.

The condition of frequent wetting by salt water, followed by exposure to the atomsphere, is a severe test. The Neponset bridge, built in 1877, was a small two-leaf trunnion bascule draw span with wrought-iron girders. The counter-weighted ends of the girders were immersed in salt water whenever the bridge was open at high tide. These girders were painted frequently, usually with red lead, and they continued in service thirty-two years, until the bridge was rebuilt.

Laboratory experiments have shown that steel stressed beyond its elastic limit will rust more rapidly than steel which is not overstressed. This seems to be borne out by experience in certain cases of highway bridges carrying constantly increasing street railway loads. When heavy cars have been put in service over these structures the outstanding legs of the flange or seat angles immediately under the stringers have been found to rust very rapidly—much faster than the metal at each side of the stringer.

Recognition of the Engineer

For years the B. C. branch of the Canadian Society of Civil Engineers have been concentrating their efforts upon placing the engineer on a better footing, so far as the public recognition of his merits is concerned. Their effotrs would appear to be succeeding in part, if one can place a favorable construction upon the importance the Vancouver Province attaches to a certain event chronicled in the following paragraph:—

> Mr. G. Miles Peters, Government Engineer in charge of the False Creek dredging operations, had blushes blooming over the whole length of his six feet four inches to-day when his friends and acquaintances became aware that the lengthy engineer had had a daughter added to the family. The Government official bore his honors with meekness and restraint but he is infernally proud just the same.

Time was when an engineer would have had to have more inches than Mr. Peters—and more daughters than one—to have merited such dignified attention at the hands of the press.

From Mr. W. A. Littlejohn, City Clerk, we have received a copy of a Municipal Handbook of the city of Toronto for 1915. This valuable publication, which is issued annually, contains complete information on practically every phase of civic activity, as well as many practical notes and statistics relating to constructional developments.

Comparative Building Costs

COMPARATIVE figures of cost always appeal to the building contractor, and those given in one of the committee reports presented at the lumbermen's mass meeting recently held under the auspices of the Forest Products Federation in the City of Chicago, cannot fail to prove of more than ordinary interest. The report in question dealt with the comparative prices of building construction, and was prepared by J. Norman Jensen, architectural engineer of the building department of Chicago.

Mr. Jensen pointed out the extreme difficulty of giving comparative costs between residences which are built of frame construction and those built of other types, but in order to obtain a comparison between the cost of small frame and brick buildings in the City of Chicago, an architect prepared complete plans and specifications of quite a number of one and two-storey buildings and then obtained bids.

Since in making any comparison, the interior finish, plumbing, etc., is assumed to be the same, the final analysis is in the cost of the walls of the building. The cost of labor and materials in place, of the walls of these small buildings, exclusive of the plastering of the walls, runs about as follows:

Frame

	Sq. ft.
2x4 in., 16 in. centres, yellow pine studding	5c
1x6 in. sheathing, and 1 layer of paper	5c
Cypress drop siding	5c
Painting	2c
Total	18c

Brick

8 in. common-brick side wall	21 to 22c
4 in. face-brick and 8 in. common-brick front wall	45 to 50c

Stucco

2x4 in., 16 in. centres, yellow pine studding	5c
1x6 in. sheathing, and 1 layer of paper	5c
Stucco on galvanized wire lath	12c
Total	22c

In the above analysis common-brick is estimated at $16 to $17 per M., material and labor. All the above prices include the contractor's profit. From this analysis it is seen that the cost of the common-brick and stucco wall is about the same, and that the walls of a frame building cost about 20 per cent. less than either of them; 4-in. face-brick and 8-in. common-brick front wall is about two and one-half as expensive as a frame front wall.

In each case in which a frame building was compared with a similar brick building the size of rooms, plumbing, trim, interior, finish, etc., were identical. In all cases the frame building had a shingle roof while the brick structure was provided with a non-combustible roof. The average of these bids on these buildings was as follows:

	Frame	Brick
One-storey cottage, 22x30 ft.	$1,719	$1,823
One-storey cottage, 20x36 ft.	2,394	2,684
One-storey cottage, 21x48 ft.	3,419	3,906
Two-storey flat, 24x34 ft.	4,185	4,564

From these figures it will be seen that the cost of the frame building was about 10 per cent. less than a similar brick building.

The substitution of inferior materials, or the using of materials less in quality or quantity than that called for in the specifications, is known to the constructor as "skinning the job." This is one of the factors which is helping to legislate against the use of lumber in mill constructed buildings. A specification is drawn up intending to obtain the best grade of material. Some enterprising dealer, or contractor, or other party, deliberately places an order for an inferior lumber. The mill man either does not know or does not care about the deception. The lumber gets on the job, and then the trouble begins. The architect or engineer condemns the sticks sent, but the owner needs his building in a hurry and accepts the lumber under protest. The architect listens more attentively to the concrete man on the next job, and the lumber salesman wonders why he does not get any more orders out of that architect's office. The architect can watch the local materials which go into his concrete building, but he does not intend to stand over the mill man perhaps a thousand miles from his office.

With regard to the cost of what is known as mill construction as compared with other types of construction, it may be stated that one advantage of the former is lower cost. Perhaps the best way to compare costs is to mention a number of actual bids on completed structures. In a certain large architect's office a design was prepared of a building which was to be erected in an old manufacturing district in Chicago. The building was five storeys and basement high, 100 by 100 feet, and designed for 280 lbs. live load. The panels in the standard mill design were 14 by 16 feet, and brick bearing walls were used throughout. The concrete building of the same height and size was designed in the most economical type of flat slab concrete skeleton construction. The actual bid for the mill constructed building was $65,100 and for the concrete type $72,200.

Another building seven storeys and basement high, 68 by 75 feet, was designed for 150 lbs. live load. The panels in both designs in this case were 18 by 16 feet. The mill constructed building cost $65,400, and the concrete building $75,300.

If wood floors had been required in these buildings, the difference between the mill and the concrete prices would have been greater than ever. In the buildings which were compared, the elevators, heating, lighting, sprinkler equipment, etc., were the same.

It is useless to attempt to make a sweeping statement as to how much a mill constructed building should cost per cubic foot, or square foot, or a concrete building on the same basis. Sometimes a mill constructed building of a certain area would have to be divided by a brick wall with fireproof doors, from basement to roof. A similar concrete building would not require this dividing wall, according to building ordinances. The cost of this brick wall alone would offset part of the cost of the concrete building. The best that can be done is to take all the known facts into consideration, and try to arrive at general conclusions, based on a great many comparative designs, and on the experience of the best architects and builders.

The writer has before him a long list of buildings constructed within the last four years in a newly developed manufacturing district in Chicago. The vast majority of these buildings are of the mill constructed type, ranging in cost from $15,000 to $225,-

000. The cost per cubic foot ranged from 6c to 11c and per square foot 80c to $1.70.

The range of costs is so great that no generalization can be made on them only. The point which the writer wishes to make is that these buildings were built of mill construction in preference to concrete or other type of construction. In a great many cases these buildings were designed in other types of construction besides mill. The same exterior walls, the same mechanical equipment, the same sprinkler system, etc., was used throughout, the only variation being the type of floor construction adopted By comparing the costs of the different types of construction, the following conclusions were reached:

With column spacing not exceeding 16 feet, mill constructed buildings designed for 100 lbs. live load cost 20 per cent. less than concrete buildings; for 150 lbs. live load, 15 per cent. less, and 200 lbs. live load about 10 per cent. less. When the live load was 350 lbs. or over a concrete building was cheaper.

It was stated that the above analysis was based on column spacing of 16 feet or less. When the required column spacing in any building is greater than 16 feet, the relative economy of mill construction disappears. It has been found, however, that the column spacing of 16 feet is ample enough for the vast majority of manufacturing and other mercantile businesses. The live load mentioned is the load per square foot which can be safely put on top of the floor. This live load is usually the weight of machinery, or goods placed on the floor. For most light manufacturing buildings a live load of 100 lbs. per square foot is sufficient, and for 75 per cent. of the buildings used for storage purposes 200 lbs. per square foot is all that will ever be placed on the floors. So the column spacing and the loads cover most of the cases which may arise.

Another point which determines the adoption of mill constructed building in preference to concrete is the fact that in ordinary lines of business the rate of insurance on a sprinkled mill constructed building and contents runs about 25c, while the rate on a concrete building and contents, unsprinkled, runs about 45c. The rate on both types of construction, sprinkled, is about the same, but the cost if installing the sprinkler system in the concrete building makes the total cost still higher in comparison with a mill building. A concrete building in which wooden floors are used cannot compete with mill construction.

Examination of concrete exposed to severe heat in the course of the fire at the Edison works, showed that the material generally was very hard and gave no evidence of calcination. The dehydration observed on the surface did not extend into the mass of the concrete, the strength of which remained unimpaired. A special committee appointed to investigate the fire state that "considering the extraordinary conditions surrounding this fire, the behaviour of the concrete buildings was highly satisfactory and constituted an excellent demonstration of the merits of concrete as a fire-resisting building material."

Some of the modern theories for reinforced concrete design are not practical and do not give the designer any means of knowing what factor of safety his constructions have, and prevent a sound development of the art of reinforced concrete construction.—L. J. Mensch, Chicago.

The Use of Sandstone in Building

ONE of the varieties of stone that has been in important use for structural and decorative purposes ever since the dawn of civilization is sandstone. This is of very wide occurrence, being found in almost every country, and it has such diversity of color and texture that it would naturally be chosen for architectural use, says Stone. Besides its beauty, sandstone has been commended to the builder by its great durability and its resistance to attacks by fire and the acids of the atmosphere. Many of the most notable buildings that have come down from antiquity are of sandstone. Temples and statues in ancient Egypt were cut in this material, although the patient craftsmen were just as willing to carve limestone, granite, or even the intractable basalt and porphyry.

In Persia and the various countries of Asia Minor, gigantic structures were reared in sandstone, the ruins of which have survived to awaken our admiration and wonder. The remarkable rock-cut temples and tombs of Arabia Petra are carved entirely from great cliffs of sandstone. The stone is a beautiful and delicate pink in color, with occasional markings in yellow, and the effect of rich carvings in such a material can scarcely be imagined.

In later times, sandstone was used very generally for cathedrals and churches in England and on the Continent. This made it possible to produce effects not only in stone of yellow and grey but also in brown, pink and red, and striking contrasts were available. It is only within the past few years that the present generation has learned the lesson of the excellent effects of polychromatic construction which might have been drawn long ago from the work of our forefathers. The varying colors of marble and sandstone enabled them freely to apply polychromy, both structural and decorative.

A Mark Twain Story

When Mark Twain in his early days was editor of a Missouri paper, a superstitious subscriber wrote him saying that he had found a spider in his paper, and asking him whether that was a sign of good or bad luck. The humorist wrote him this answer and printed it:—

"Old Subscriber: Finding a spider in your paper was neither good luck nor bad luck for you. The spider was merely looking over our page to see which merchant is not advertising, so that he can go to that store, spin his web across the door, and lead a life of undisturbed peace ever afterwards."

Investigation in connection with electrolytic action on fifteen hundred concrete poles on the Utica-Syracuse lines of the New York State railways during the last five years show of these poles only three developed defects, which, upon investigation, proved to be directly traceable to leakage of the 600-volt trolley current through the reinforcing rod to earth. In every case ample warning of the failure was given by the gradual cracking of the concrete long before the pole was liable to fail altogether. The main interest of the investigation is the conclusive manner in which it contradicts the gloomy forebodings sometimes expressed by the opponents of reinforced concrete on the subject of electrolysis.

The Efficient Control of Reinforced Concrete Construction*

A number of casualties have attended construction in concrete. A sudden collapse of a portion of a reinforced concrete building in a large city, attended with loss of life of workmen, generates in the public mind a fear of concrete construction; and a prospective builder is likely to resort to a less permanent and less fitting style of building because of the uncertainty. He knows that a concrete building is serviceable and permanent after the cement has set, but he fears the risk arising during construction.

Structural engineers, on the other hand, know that the percentage of failures is small, and the accidents to be avoidable.

Dangerous conditions in reinforced concrete construction arise from (1) inadequate designs; (2) defective materials, and (3) unfavorable weather conditions and lack of care under those conditions.

All of these elements may be, and are, controlled in the larger cities by building codes and active inspection. For instance, in the city of Chicago, which has an unusually efficient and watchful building department, there have been no serious failures of reinforced concrete buildings under construction. In this city designs are checked over very carefully to see that they conform with the conservative practice established by the building code of that city.

It is in the smaller cities, that are not large enough to demand permanent buildings, but without building codes, that the most dangerous conditions obtain.

The building codes are thought to be too conservative by some designing engineers of companies interested in the sale of materials. For instance, while these codes generally permit 16,000 lbs. stress per square inch upon ordinary reinforcing steel, some designers will increase this to 20,000 lbs. where the code does not prevent, and under circumstances where the sale of the material depends upon a low total price.

Many buildings have been erected under designs that are not conservative and yet have given good service. Their construction has been under favorable conditions with reference to cement, sand, weather conditions, and skill of workmen; and the lack of factor of safety in design has been counter-balanced by the increased factor of safety in materials.

Codes, however, must recognize average conditions. The architect or structural engineer or commercial firm supplying material, who has drawn upon the factor of safety in design, and then has met unexpected conditions in the materials, weather conditions, etc., and has a failure on his hands, is certainly in a weak position.

The larger number of failures of concrete buildings occur during the late fall when the low temperature and wet weather prevent the cement from hardening properly. At this time, too, the owner is anxious to get into the building. Every one is in haste; forms are struck before the concrete is hard enough to support the floors above; the roof, which is often the weakest part of the design, is being covered with cinders into which the rain seeps. Instead of weighing 45 lbs. per cubic foot, the weight of these cinders may run up to 100 lbs. per cubic feet. Then, too, the plumber may seriously overload a portion of the floor with piles of pipes, may even remove a form support. Under these conditions it is no wonder that failures occur. In the presence of these unfortunate failures a designer who has furnished a conservative design is in a strong position.

The writer has investigated and made reports upon several failures in which it has been necessary to criticise the design. In some of these cases the architect has originally made a conservative design with sufficient materials and proper connections. The sales engineer of a company supplying steel has afterward prevailed upon the architect and owner to allow a substitute design. The latter is shaved down to the lowest limit, involving high stress in steel, short laps for bond, and defective continuity. While the substitute design will save in the cost of steel, the per cent. saved on the cost of the entire building is usually small and will no justify the risk of the entire structure.

While recognizing the fact that methods of construction and dimensions of structures proceed partly upon experience and the desire for economy, the writer urges that, in the case of reinforced concerte, designs should follow building codes and the report of the conservative practice as fixed by the joint committee on concrete and reinforced concrete which has recently been adopted by the American Society of Civil Engineers and the American Society for Testing Materials.

The standard designs of some of the constructing companies are also reliable and conservative. A special mention might be given to the Kahn standards of the Trussed Concrete Steel Co., Detroit, and those of the Corrugated Bar Co., Buffalo, for the dimensions of beams and girders of ordinary floors and roofs.

The codes, however, are naturally behind hand in respect to the newer forms of construction, such as the so-called "flat slab" design.

In construction with new materials the tendency is to follow forms that have been developed for old materials. Thus the first reinforced concrete building used the old wooden construction of girders, floor beams, and slabs between the latter.

In another line the first railway coaches were patterned after stage coaches.

Reinforced concrete, however, is continuous, like the old constructions.

The flat slab designs omit girders, and floor beams. There is a continuous slab over the entire floor, and it rests upon and is monolithic with the expanded heads of the columns.

The steel is disposed in either a four-way system or a two-way system.

These constructions are usually patented. Advantages are (1) the better lighting of the room, (2) the increased head room, (3) decreased storey height, (4) more simple installation of sprinkling systems, (5) simpler form work, and (6) a construction more in keeping with the material.

The construction is generally considered more suitable for loads up to 500 lbs., and columns spacing up to 24′ than for larger loads and wider spacing. When the panel becomes rectangular instead of square, the long side should not exceed the short side more than 1-3 part.

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*By W. K. Hatt, in the Ohio Architect.

The depth of slab should be at least 1-30 the span between column centres.

The design of the expanded head of the column needs attention. It should be stiff.

The steel is in the bottom of the slab at the centre of the panel, and passes up to the top of the slab near the quarter point of the span.

The steel that passes from one panel to another should lap well over into the next span at least 60 diam. beyond the edge of the column cap. And where both bars are counted upon as reinforcing over the column, they should keep well up in the top of the slab over the column, and run 60 diam. beyond the quarter point of the span.

The amount of steel should be about the same in the various patented arrangements for given loads and spans.

Over the column head, the amount of steel should be sufficient to resist an external bending moment equal to 1-15 W/L (for interior square panel); where W=total load, live and dead, on panel; L=span centre to centre of column along direct line.

Carbon-Paper Tracings for Blue-Printing

An interesting expedient was adopted by Lloyd T. Emory, of Philadelphia, Pa., for getting out a set of working plans in a hurry, and is described in Engineerings News. The only drawing materials on hand were two triangles, a hard pencil and a scale. Getting some tough tissue paper from a dressmaking establishment, he first made the drawings in pencil on the tissue paper, then laid some sheets of carbon paper face up on the table with the tracings over them and retraced all the lines of the drawings, thus backing them with the imprint of the carbon. Only 48 hours was available for the set of plans. In 20 hours straight work they were completed, and time enough was left to get them printed in the blue-printing room of a local shop. He had since used the idea extensively.

The claim is made that with carbon tracing a paper drawing can be done in one-fourth or one-third the time of making an ink tracing; but not all draftsmen will agree on this point. In any event the method is applicable only to simple drawings—large-scale details and the like—and not to drawings with fine detail, etc.

When several drawings with the same foundation work but with alternative details are to be made, a modification of this method might be applied, using double-faced carbon paper and two or more sheets of paper.

Extensive public and private works are in progress in many parts of New Brunswick. The contract has been awarded by the Provincial Government for the construction of a new bridge across the Petitcodiac at Moncton. The contractors are already on the ground and hope to have the substructure well advanced before cold weather sets in. Three large churches are in course of erection at Moncton. A school building of large size, and a city hall and market are also planned. Bathurst has awarded the contract for an extensive water and sewerage plant. The contract price is about $131,000.

Mainly Constructional

East and West—From Coast to Coast

John G. Scurry, a railroad engineer, widely known on the Pacific Coast, died last week at Seattle. The late Mr. Scurry was seventy years of age.

On the recommendation of Mr. M. J. Butler, the Montreal Council have decided to expend $360,000 on the construction of a retaining wall on the north side of the filtration plant.

Mr. W. A. McLean, Chief Engineer of Highways for the Province of Ontario, has submitted a report in connection with the completion of the Toronto-Oshawa road, which he estimates would cost nearly $300,000.

The new factory which is to be erected at Hamilton, Ont., for the T. Eaton Company, Limited, is to cost $150,000. The proposed building is L-shaped in design, four storeys high, of reinforced and brick construction.

Although by no means brisk, there is a slight improvement in the builders' supply trade of Montreal. This, of course, is the busiest period of the season, and the local demand, together with buying from the province of Quebec, has helped to make the situation more favorable.

The Mayor of Toronto is authority for the statement that the last obstacles in the way of constructing the new Union Station at Toronto have been removed. He states that the Toronto Terminal Company is now in possession of ample funds and that the contractors, the Lyall Construction Company, are ready to go on with the work.

With the name of Boving Hydraulic and Engineering Company, Limited, J. B. Flavelle, W. Flavelle, D. McLean, J. Carew, and T. H. Stinson, all of Lindsay, Ont., have incorporated a company for the purpose of carrying on the business of mining, electrical, mechanical, hydraulic and civil engineers and contractors. The capital stock of the new company is $500,000.

Mr. F. McArthur, City Engineer of Regina, is leaving the West shortly to return to Guelph as City Engineer. This is the second time that Mr. McArthur has been City Engineer of Guelph so that he has the particular advantage of being familiar with engineering conditions in the Royal City. He first went to Guelph as City Engineer in 1898, fresh from graduation at Queens University, Kingston, and went to Regina three years ago.

The Canadian steel industry would appear to have great possibilities according to a report given out last week in Montreal by Mr. A. M. Rogers, who had just returned from a tour through Nova Scotia. Mr. Rogers is authority for the statement that both the Dominion Steel Corporation and the Nova Scotia Steel Corporation are working full blast, having tremendous war orders. They are engaged in making rails, rods, billets, and nails, and the Dominion Company are also manufacturing toluol, the new high explosive base secured from coal tars.

Mr. Angus Smith, City Engineer of Prince Arthur, Sask., has received the degree of C. E. from the University of Toronto. Mr. Smith graduated from the School of Science in the year 1894 and has been constantly engaged in municipal engineering since that date. It is of interest to note that Mr. Smith has the distinction of having built the only sea walls for foreshore protection in Canada—one the Dallas Road sea wall and the other the Ross Bay sea wall at Victoria, B. C., the former being 1,700 feet long and the latter 3,800 feet long. These walls were built at the same time, but they are absolutely different in design—each being suitable for its particular situation. The structures have withstood severe storms during the past four years and they are considered one of the engineering points of interest at the coast.

Preparations are being made for the installation of equipment in the rooms set apart for the Ceramic Laboratory at Toronto's new Technical School. A kiln will be constructed under the direction of Mr. A. F. Greaves-Walker, of the Sun Brick Company. The design is the same as that made by Mr. Walker for the new Government testing plant at Ottawa and erected under the direction of Mr. Joseph Keele. A re-press is being presented by Mr. J. E. Frid, president of the C. N. C. P. A. H. C. Baird, Son & Company, of Parkhill, Ont., will supply a No. 2 Kells machine with clay feeder, and an 8 x 20-in. end delivery pugmill, together with the necessary cut-off tables and dies. This equipment will be installed at an early date, and will be ready for the beginning of the course in ceramics this fall. The Sun Brick Company, of Toronto, are giving a Martin upright six-brick stock ma-

The Canadian Western Foundry and Supply Company is the name of a new corporation, organized and financed by Alberta men, which will form an important addition to Calgary's industrial concerns. The new company has been formed by an amalgamation of the International Supply Company, of Medicine Hat, the Western Foundry and Equipment Company, of Calgary, and the Canadian Equipment and Supply Company, of Edmonton and Calgary. It is capitalized at $1,000,000 and its officers are as follows: President, W. H. McLaws; Vice-President, T. A. McAuley; Treasurer, F. Leslie Bell; Secretary, A. T. MacWilliam; Manager, Geo. A. Mackenzie. The company will handle plumbing and heating supplies, builders' supplies, railway contractors' supplies, oil and gas well supplies, and heavy foundry and brass work. They will make a specialty of heating and ventilating returns for schools and churches. The company's plant at Medicine Hat is now working night and day making high explosive shells for the army.

The Passing of a Great Engineer

Sir Sandford Fleming, the distinguished engineer who was regarded as the Dean of the profession in Canada and as "the father of the Canadian Pacific Railway," died last week at Halifax, N. S., at the advanced age of 88. Born at Kirkcaldy, in Fifeshire (Scotland), in 1827, he came to Canada at the age of eighteen and joined the engineering staff of the Northern Railway, Toronto, of which subsequently he became Chief Engineer. In 1863 he was appointed by the British and Canadian Governments to conduct a survey for the first link of a railway joining the Atlantic and the Pacific. His plans showed the practicability of the scheme, which developed when carried out into the Canadian Pacific Railway system. Among many of his other important enterprises was the railway system of Newfoundland. In 1877 her late Majesty Queen Victoria made him a Companion of the Order of St. Michael and St. George, and he became a Knight Commander in 1897. Sir Sandford Fleming had received honors from many of the leading universities. He had been Chancellor of Queen's University several times.

Sir George E. Foster, Acting Premier, pays the following tribute:

"The death of Sir Sandford Fleming deprives Canada of one more of its outstanding men. His connection with the early history and construction of the Intercolonial Railway, his intelligent and very useful contribution to the construction of the first transcontinental railway, and his eminent services in respect of the Pacific cable connecting the Australian and the Canadian colonies entitled him to high rank among the pioneer builders of the Empire, and gave him a distinguished place in the history and development thereof. As a man and a citizen he had enjoyed long years of respect and esteem, and had contributed worthily to the upbuilding and ideals of the communities in which his labors were so faithfully bestowed."

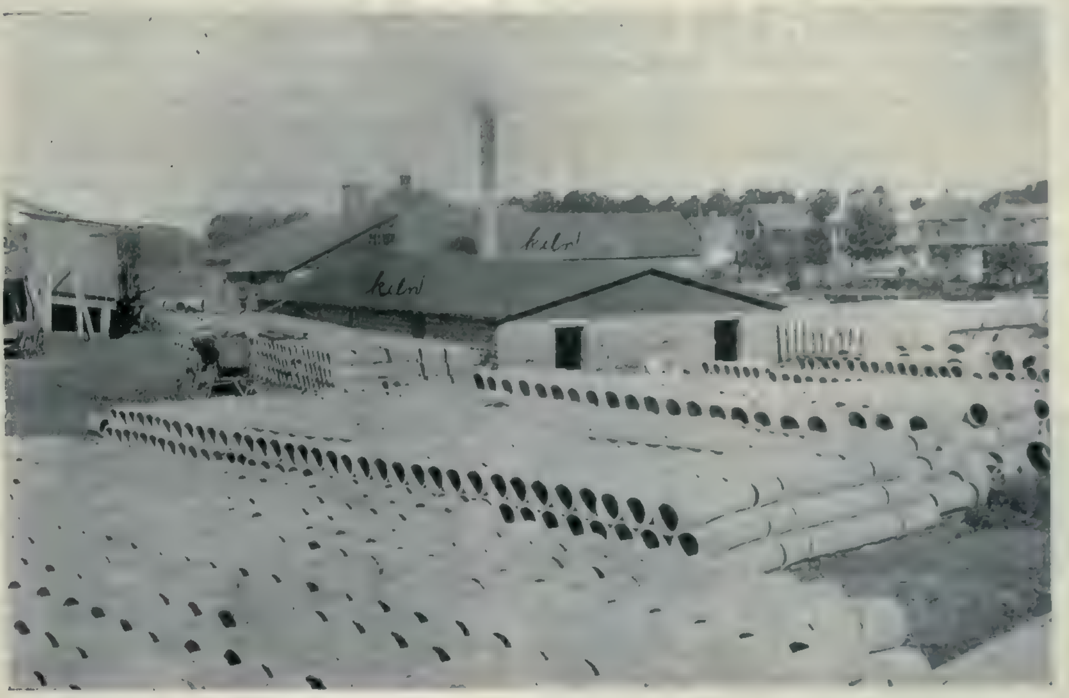
A particularly significant tribute is paid the late Sir Sandford Fleming in a leading editorial in "The Globe" (Toronto), of which the following is an abstract:

"It is no exaggeration to say that Canada has never had a citizen more distinguished or better known to the world at large than the late Sir Sandford Fleming. A native of Fifeshire, Scotland, he came to Canada at eighteen, and during the seventy years between his advent and his passing he was from first to last the architect of his own fortune and fame. With only a moderate amount of educational preparation, either general or special, to start on his professional career, he left behind him a record of individual achievement in his own line that is and must always remain both unprecedented and unparalleled.

"He was fortunate in coming to this country at a time when great projects were much in the minds of Canadian and British statesmen. Railway building was just in its infancy when he joined the engineering staff of the Northern Railway, and in 1857 he was promoted to be its chief engineer. In 1863 he was asked to report on the feasibility of connecting the then Province of Canada by rail with the Red River Valley. Quite naturally he was entrusted in 1867-71 with the routing and construction of the International Railway, and after the purchase of the Hudson Bay Territory by the Dominion of Canada he was just as naturally put in charge of the greater undertaking, the Canadian Pacific Railway. From 1871 to 1877 he was in full charge of the difficult task of exploring the West, selecting a route for a transcontinental railway, and planning the style of line that would best promote the various purposes it was designed to serve: colonization, transportation, and inter-communication. The intercolonial and transcontinental railways within the Dominion are Sir Sandford Fleming's enduring professional monuments.

"In his private pursuits the bias of his mind was not merely theoretically scientific but practically constructive. He was always the "engineer," but always also the "scientist." By dint of intellectual ability and untiring industry he not only kept himself abreast of the scientific movements and discoveries of others, but acted as a pioneer in making and publishing discoveries of his own. He was a persistent and ultimately successful advocate of a transpacific submarine telegraph line. He was the first to suggest what is known as "standard time," which is now in use over most of the civilized world. He was the author of numerous monographs of a scientific character, in which he published to the world the conceptions that were the outcome of his own inexhaustible versatility. It is fitting to mention in this connection the great service he rendered to the cause of science in Canada by the active part he took in founding the Canadian Institute, for which he never ceased to display a friendly and helpful sympathy.

"Unlike many members of his profession, Sir Sandford was deeply interested in higher politics and political history. He was always an ardent but sane Imperialist, and when the "Trent affair" came to Canadians in 1861 as a trumpet call to active defensive service, he raised a company of volunteers in this city. Like many other thoughtful observers, he saw clearly the remediable defects of the ordinary method of electing representatives to Parliament, and he thought out and published practical suggestions for its betterment. He was always ready to assist in movements to commemorate the sites of great historic events. The high esteem in which he was held is amply shown by the honors paid and the distinctions conferred on him by learned bodies and institutions. In private life Sir Sandford was one of the most charming of men: intellectual, cultured, courteous, but withal unostentatious, and unaffected. We shall not soon look upon his like again."



Plant and pipe storage yards of the B. Blair Company, Limited, at Woodstock, Ontario.

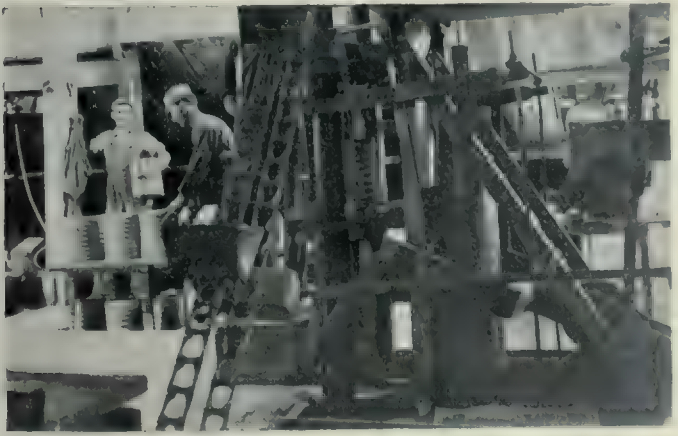
The Manufacture of Concrete Pipe on a Large Scale

The manufacture of concrete pipe is carried on on a considerable scale in Woodstock, Ont., at the plant of the B. Blair Company, Limited, which is specially equipped for the manufacture of these pipes in sizes from 4-in. to 36-in. The factory is equipped with a 30 h.p. steam plant, and two 15 h.p. motors, 3 stone crushers, concrete mixer, cement tile machine, and a large power tamper. For the hardening of the pipe after moulding there are two large vaporizing chambers, and seven chambers for the smaller sizes. These chambers have over 6,000 feet of floor space, and are all fitted with a system of overhead water pipes for spraying concrete pipe during the process.

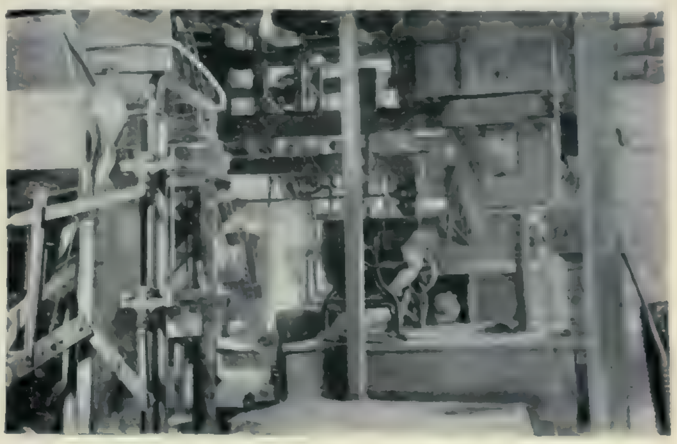
Gravel is placed in a No. 3 Eureka crusher and delivered to a large storage bin. A bucket conveyor takes it from the bin as needed to a revolving screen, where the sand is separated from the stone, which is further reduced in a No. 2 crusher to an aggregate suitable for making tile. This aggregate ranges from fine sand to 5/16-in. stone, and is measured into a batch concrete mixer with sufficient cement and water to make a gum mix consisting of one part cement, one part sand, and two parts stone.

Concrete is passed automatically by bucket conveyor to the moulds for the smaller pipe or to the power tamping machine for the larger pipe. This tamping machine strikes 150 blows of 350 pounds every minute, which gives the pipe great density. After moulding, the pipes are placed in the vaporizing chambers for 72 hours, where they are subjected continuously to fine sprays of water in a temperature of 110 deg. Pipe cured under this system have been tested to a pressure of 60 pounds to the square inch without showing any signs of seepage.

The capacity of the plant is three carloads a day. The



Power machine making pipe from 4 to 16 inches in diameter.



Power pipe machine, batch mixer, measuring box and storage bin.

power tile machine has a capacity of 3,000 feet a day of pipe ranging in size from 4-in. to 14-in. The large power tamper has a capacity of 600 feet day of 14-in. to 36-in. pipe. For making extra large concrete pipe the company have three portable plants which can be shipped to any point and placed where required for the making of the large pipe. The larger pipe, from 24-in. upwards, are all reinforced with heavy Hy-Rib Metal or Triangular mesh.

The firm have patented an entirely new feature in connection with their concrete pipe. By means of a special circular form a square slot is pressed around the joining ends of the pipe. When the pipe are joined together the slot is filled with a flowing cement batter or a liquid asphalt which forms a perfect bond when thoroughly set, and makes the joint absolutely watertight. The cut herewith illustrates the manner in which this joint, when set, not only forms a waterproof ring, but bonds the ends of the pipe together. The advantage of a lock joint of this character can readily be seen, since the pipe when laid in a trench make one continuous line as strong at the joints as in any part of any pipe section.

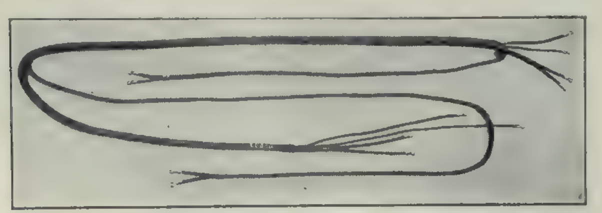
Interior of vaporizing chamber for large pipe, where pipe remain for 72 hours.

Mr. B. Blair has made a close study of concrete sewer pipe for the last seven years, and has visited the leading plants in the United States, with the result that the company's Woodstock plant is one of the largest in America, both in point of equipment and in capacity.

Mr. Blair is President of the American Concrete Pipe Association, having held this office for two, years.

Cable Assemblies for Motor Cars

The Standard Underground Cable Company of Canada, Limited, Hamilton, Ont., are furnishing their automobile cables in assembled or "harness" form, as shown in the illustration, complete with terminals and ready for installation. This method of selling cable was adopted by this company as a convenience for the buyer and it is said to also possess the advantage of economy, and to make for neatness, since a good assembly makes the best looking installation on the finished car. The assemblies are made up to suit the dimensions of the cars on which they are to be installed and, since the necessary terminals are already attached, there is nothing to be done in installing the cable but make the connections.



Automobile cables manufactured by the Standard Underground Cable Company of Canada, Limited.

Centrifugal Blowers and Compressors for all pressures from 5 inches of water, as in mechanical draft service, up to 125 lbs. per square inch, as for compressed air distribution in mines, machine shops, ship yards, etc., are described in a 64-page book issued by the De Laval Steam Turbine Company, of Trenton, N. J. The development of the high efficiency, high speed centrifugal blower or compressor has been conditional upon improvements in materials, construction, shop practice and design such as are employed in the building of high grade steam turbines. By careful calculation of stresses, and by the use of good materials and workmanship, it is possible to run blower and compressor wheels safely and satisfactorily at peripheral velocities of 450 to 600 ft. per second, which makes it possible to develop as much as 3 or 4 lbs. per square inch pressure in a single-stage blower. In the present publication numerous charts are given, showing curves for the isothermal, adiabatic and actual compression of air, also the theoretical power required to compress air and characteristic curves of single—and multi-stage blowers and compressors. The influence of impeller design upon the form of the characteristic is discussed at some length. Particulars are given concerning the application of centrifugal blowers and compressors to forced draft, coal gas manufacture, coke oven plants and water-gas plants, sugar factories, cupola and blast furnace work, Bessemer converters, supplying compressed air in mines, ship yards, etc. The illustrations present numerous examples of blowers and compressors directly connected to steam turbines and to electric motors.

Brass-Wire Armored Cables for Motor Cars and Motor Boats

The Standard Underground Cable Company of Canada, Limited, Hamilton, Ont., are manufacturing a complete line of brass-wire armored ignition, lighting and starting cables for motor cars, motor boats and other motor-driven vehicles.

Brass-wire armored cables—Standard Underground Cable Company.

This armor is in the form of a strong "D" shaped ribbon, wound closely over the cable, and is supplied in yellow, antique or nickel-plated finishes. Galvanized steel wire armor is occasionally used though somewhat less durable in construction. The insulation of these armored cables consists of high grade rubber, varnished cambric, and waxed and varnished braids. Other types have plan rubber insulation without braided covering. The outer braid of the braided cables is saturated with multiple coats of special varnish which give it durability even when not further protected by the brass-wire armor.

"A handful of clay—man. A shovelful of iron ore—a metal sheet." In this unique fashion an unusually interesting treatise on the subject of the corrosion of iron and steel sheets commences, and throughout the entire narrative the reader's interest is held by the writer's ingenious method of handling a subject which is usually technical and "dry" to the layman. The booklet is entitled "Corrosion—The Cause —The Effect—The Remedy" and has just been issued by The Stark Rolling Mill Company, of Canton, Ohio. It is well worth writing for.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Beauceville, Que.
The Town Council will call for tenders shortly on the construction of waterworks, drainage and lighting systems. Engineer, F. Mignault, Sherbrooke, Que.

British Columbia Province
A proposition is on foot for the construction of an 80-foot international road from Blaine and White Rock to Sumas and Huntingdon. Reeve of Matsqui, A. Cruikshank.

Brockville, Ont.
Work is about to start on the construction of an intake pipe for the City Council. Material has been purchased and work will be done by the Board of Works.

Calgary, Alta.
Work will start shortly on the construction of a number of sewers. Engineer, G. W. Craig.

Chatham, N. B.
The proposed reservoir will probably be built by day labor. Material will be purchased by the Engineer, A. N. McKay, and D. P. MacLachin. Estimated cost, $20,000.

Dartmouth, N. S.
Work has been started on the laying of 9-inch sewers and 6-inch watermains under supervision of the Engineer, Eugene Nichols.

The Town Council are considering the extension of the sewer and watermains on Erskine Street. Clerk, A. Elliott.

East Oxford Township, Ont.
Tenders will be received until August 9th by F. G. Jackson, Oxford Centre, for the construction of 800 feet of open ditch drain and approximately 10,300 feet of tile drain, varying in size from 5-inch to 12-inch. Engineer, F. J. Ure, Woodstock.

Elmira, Ont.
The Town Council are considering the installation of a sewage system, estimated to cost $25,000. Engineer, H. J. Bowman, Court House, Berlin, Ont.

Grimsby, Ont.
Tenders on the construction of a cement roadway are being received by the Town Clerk, C. H. Bromley.

Napanee, Ont.
The Town Council propose to lay sewers and concrete sidewalks on several streets. Clerk, W. A. Grange.

Ottawa, Ont.
Work is about to start on the construction of a concrete sidewalk on Carling Avenue, estimated to cost $6,000.

Perth, Ont.
The Town Council have submitted plans for a filtration system to the Provincial Board of Health for approval. Estimated cost, $15,000.

Preston, Ont.
The Town Council have authorized the construction of sewers on a number of streets, at an estimated cost of $8,195. Engineer, C. S. McKenzie.

Regina, Sask.
The City Commissioners will receive tenders until September 6th for the supply of two turbine pumps, each capable of delivering 3,500,000 gallons per day against a pressure of 60 lbs. per square inch. Clerk, George Beach.

Saskatchewan Province
Tenders on the construction of drainage ditches in the province will be received until noon, August 7th, by F. J. Robinson, Chairman of the Board of Highway Commissioners, Parliament Buildings, Regina. Work includes approximately 50,000 cubic yards of excavation. Plans and specifications with the Chairman.

Toronto, Ont.
The Board of Control will receive tenders until August 17th for filling in Catfish Pond and constructing a sewer in connection therewith. Plans at Room 34, City Hall.

Welland, Ont.
The Welland County Council propose to spend $160,000 on improvements to the County roads during the year. The scheme has been submitted to the Provincial Department for approval. Clerk, J. E. Cohoe, 32 Maple Avenue, Welland.

CONTRACTS AWARDED

Bedford, Que.
The contract for the erection of a steel water tank for the Town Council has been let to the Jenckes Machine Company, Limited, at $4,675.

Chatham Township, Ont.
In connection with the dredging work in the Townships of Chatham and Dover, the contract for the supply of pumping machinery has been let to the Chatham Bridge Company, Inches Avenue, Chatham, at $7,700, and the dredging contract to the Chatham Dredging Company, Chatham W., at $6,000.

Cornwall Township, Ont.
The general contract for the construction of the Shaver Creek Drain has been let by the Township Council to James A. Valade, Harrison's Corners, Ont., and he has sub-let to the Van Busen Excavator Company, Crown Life Building, Toronto.

Lambeth, Ont.
In connection with the installation of a waterworks system, the Village Council have let the contract for well drilling to Wright Bros., Petrolia, Ont., at $3 per foot.

Pelham Township, Ont.
Contracts for drainage work have been let by the Township Council to G. Vanalstine, Crowland, Levi Chambers, Fenwick, W. S. Nelson, Fenwick, Charles Bowman, Fenwick, and Adam Bossart, Chantler P. O.

Preston, Ont.
The contract for laying asphalt pavement on King Street for the Town Council has been let to the Standard Paving Company, Central Chambers, Ottawa.

Saanich, B. C.
A contract for a large amount of paving has been let by the Municipality to the Warren Construction Company, Portland, Ore.

St. Catharines, Ont.
The City Council have let the contract for the construction of bitulithic pavements to the Warren Bituminous Paving Company of Ontario, Limited, McKinnon Building, Toronto.

Waterloo, Ont.
The Town Council have let a contract for the construction of concrete sidewalks to Paul Bergmann, King St.

Windsor, Ont.
The Board of Works have recommended that the contract for sewers on Giles, Howard, Goyeau and Alley Streets be awarded to Merlo & Ray, Tecumseh Road, at $7,300.

Railroads, Bridges and Wharves

Grantham Township, Ont.
Tenders on the construction of a concrete bridge will be received until 6 p.m., August 6th, by L. S. Bessey, Queenston Street, St. Catharines. Plans and specifications with the Engineer, F. N. Rutherford, 24 Queen Street, St. Catharines.

Kingston, Ont.
A by-law has been passed permitting the Canadian Locomotive Company, 2 Kingston Road, to construct a trestle and railway switch over the city water lots near William Street.

Levis, Que.
The Municipal Council have had plans drawn for a wharf, estimated to cost $10,000. Engineer, C. Lessard.

Swan River, Man.
Tenders will be received until August 10th by Joseph Armstrong, Box 153, Swan, for the construction of steel superstructure for the Corbett Bridge over the Swan River. Plans and specifications at office of the Provincial Engineer, Parliament Buildings, Winnipeg.

Toronto, Ont.
The Board of Control have had plans prepared for the pedestrian subway to be constructed at Ashdale Avenue. These will be submitted to the Dominion Railway Board. Estimated cost, $11,500.

Work by day labor has been started on the construction of the Innes Avenue Bridge. Approximate cost, $7,000. Commissioner of Works, R. C. Harris, City Hall.

CONTRACTS AWARDED

British Columbia Province
Work has been started on the construction of an extension from Lillooet to Hundred Mile House for the Pacific Great Eastern Railway, 325 Howe Street, Vancouver. The general contract has been let to P. Welsh, and the contract for trestle work to Cullitan Bros. Approximate cost, $3,000,000.

Campbellton, N. B.
The contract for the construction of a dam for the Shives Lumber Company, Limited, has been awarded to W. J. Hunter, Sussex, N. B.

La Loutre, Que.
The general contractors for the dam which is to be built here for the Quebec Streams Commissioners, 264 Parliament Buildings, Quebec, have let sub-let all work to Fraser, Brace & Company, Power Building, Montreal.

St. Ambroise de Kildare, Que.
The Municipality have let a contract for the erection of two steel and concrete bridges to Patrick Marcil, Joliette.

St. Casimir, Que.
The contract for the construction of a steel and concrete bridge over the Steanne River has been awarded by the Municipal Council to Gauthier & Julien, Portneuf Station. Estimated cost, $5,000.

St. Cyprien, Que.
The contract for the construction of bridge abutments for the Municipal Council has been awarded to Lorrain & Daignault, Napierville. Sub-contracts will be let for the steel superstructure.

Tay Township, Ont.
The contract for the erection of a bridge for the Simcoe County Council has been awarded to G. Dupont, care of R. J. Fletcher, Barrie.

Public Buildings, Churches and Schools

Beamsville, Ont.
A by-law will be submitted shortly to authorize the borrowing of $20,000 for the purchase of a site and the erection of a high school. Chairman of the School Board, Mark Fampton.

Bishop's Crossing, Que.
Plans of a school are being prepared for the School Board. Committee, C. C. Rolfe and D. P. McHarg.

Calgary, Alta.
Tenders on the construction of a standard magazine will be received until noon, August 16th, by the Director of Contracts, Militia Headquarters, Ottawa. Plans and specifications at office of the Officer Commanding Military District No. 13, Calgary, and of the Director General of the Engineering Service, Birks Building, Ottawa.

Cardale, Man.
Tenders are now being received on the erection of a two-roomed school for the Consolidated School Board. Plans and specifications with the Engineer. Alternative construction, lumber or brick veneer. Secretary, Robert Henderson, P. O., Cardale.

Field, Ont.
The contract for plumbing and heating at the church in course of erection here for the Roman Catholic Diocese of Sault Ste. Marie will be let by the Bishop, Rt. Rev. D. J. Scollard, North Bay.

Ford City, Ont.
Tenders on all trades required in alterations to the Parish House will be received until August 15th by the Architects, G. Jacques & Company, 5 Sandwich Street E., Windsor. Frame and brick construction, metal shingle roofing. Approximate cost, $6,000.

Levis, Que.
The Department of Militia, Ottawa, are considering repairs to Fort No. 3. Minister, Hon. S. Hughes, Ottawa.

New Liskeard, Ont.
Work has been commenced by day labor on the erection of a church for the Roman Catholic Congregation. Architect, Charles A. DeLisle, New Liskeard. Estimated cost, $5,000.

Romney Township, Ont.
Tenders are being received for all trades required in the erection of a school in Section No. 6. Architect, S. G. Kinsey, 14 Fifth Street, Chatham.

St. Agathe des Monts, Que.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 9th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with J. B. Reid, Clerk of Works, St. Agathe, R. L. Deschamps, Overseer, Central Post Office, Montreal, and at the Department, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

St. Thomas, Ont.
Plans for a school to be erected on Yarmouth Heights for the Public School Board are being prepared by J. F. Findlay, 386 Talbot Street. Red brick construction, slate roofing. Approximate cost, $5,500.

Summerside, P. E. I.
Tenders on heating, plumbing and wiring at the addition to the school on Ottawa Street will be received until August 10th. Secretary to the School Board, A. G. Burrows.

Toronto, Ont.
The Property Committee of the Board of Education have approved plans for a six-roomed addition to the John Fisher School, and for a twelve-roomed annex to the Dovercourt School. Tenders will be called shortly. Secretary, W. C. Wilkinson, City Hall.

Tenders will be received until August 10th for the erection of a Public Library at Kew Beach. Architects, Eden Smith & Sons, 199 Yonge Street. Stone and brick construction, slate roofing. Approximate cost, $20,000.

Tenders will be received until August 10th for the erection of a library at Kew Beach and another at Roncesvalles Avenue and Wright Street. Architects, Eden Smith & Sons, 199 Yonge Street. Estimated cost, $20,000 each.

CONTRACTS AWARDED

Aneroid, Sask.
The general contract for the erection of a school for the Consolidated School District has been let to F. Rooney, Third Avenue, Weyburn. Approximate cost, $11,000.

Brantford, Ont.
The contract for plumbing at the Central School has been awarded to R. H. Ballantyne, 3-7 King Street, at $8,000.

East Kildonan, Man.
The contract for alterations and additions to the Municipal Hall has been awarded to C. R. Lay, East Kildonan Road.

Elmira, Ont.
The following contracts have been let in connection with the school erected on William Street:—ceilings, Preston Metal Company, Preston; painting, R. Ruppel, Elmira; electrical work, T. Sherington; interior fittings, Globe Furniture Company, Shantz Avenue, Waterloo.

Fredericton, N. B.
The contract for the installation of a steam heating system at the York Street School has been let by the Board of Trustees to R. Chestnut & Son, Queen Street, at $3,250.

Harrow, Ont.
Henry Holt, Kingsville, has commenced the erection of a school for the Salem School Trustees. The contract for heating has been let to the Kingsville Hardware Company, Main Street, Kingsville. Estimated cost, $4,000.

Hull, Que.
The following contracts have been let in connection with the school in course of erection on Farley Road:—carpentry, Louis Lemieux, Laurier Avenue; plastering, Max Boulay, Hull; painting, E. Jacques, Champlain Street; heating and plumbing, A. Archambault, Box 224; electrical work, Raoul Viau, Notre Dame Street.

Laval des Rapids, Que.
In connection with the novitiate in course of erection for the Christian Brothers, 44 Cote Street, Montreal, the contract for steel work has been let to the Phoenix Bridge & Iron Works, Limited, 83 Colborne Street, the roofing contract to M. Chouinard, 751 Adam Street, and the carpentry contract to E. N. & U. Boileau, 312 Fabre Street, Montreal. Plastering, painting and heating not let.

London, Ont.
The sub-contract for painting at the school in course of erection on Riverview Street has been let to Jolly & Company, 190 Dundas Street.

Matchedash & Tay Townships, Ont.
The general contract for the erection of a school in School Section No. 8 has been let to J. A. Orton, Front Street, Orillia. Approximate cost, $4,500.

Medicine Hat, Alta.
The contract for the installation of fixtures at the Post Office has been let by the Dominion Government Department of Public Works to the Berlin Office & Fixture Company, Limited, 34 Lancaster Street W., Berlin, Ont., at $3,398. Work includes a marble dado.

Montreal, Que.
In connection with the repairs being made at the Court House, the plastering contract has been let to D. Contant, 3160 St. Dominique Street. Painting not let.

The City Council have let the contract for plastering at the Rubinstein Public Baths to the general contractor, A. Archambault, 610 Lafontaine Park, and for electrical work to J. A. St. Armour, 2171 St. Denis Street.

The contract for marble and tile work at the Royal Victoria Hospital, Pine Avenue, has been let to James Walker

Hardware Company, Limited, 252 St. James Street.

Newport, Que.
The contract for metal roofing at the new Roman Catholic Church has been let to L. G. Bilodeau, Trois Pistoles. Contracts for heating, glazing and sculpture work will be let later. Other work will be done by the general contractor.

Pense, Sask.
The Town Council have awarded the general contract for the erection of a Town Hall to Troup & Warner, Pense, at $3,435. Material has been purchased.

Port Dalhousie, Ont.
The Trustees of the Roman Catholic Church have let the following contracts in connection with the school now being built:—masonry and plastering, Newman & Son, 75 St. Paul Street, St. Catharines; carpentry, C. F. Monk, Wilson Street, St. Catharines; painting, Leach & Jones, 46 James Street, St. Catharines; heating and plumbing, O'Gorman & Hemphill, 39 Geneva Street, St. Catharines.

Quebec, Que.
The contract for steel work at the Hospital in course of erection on St. Foye Road for the Bon Pasteur Convent has been let to the Eastern Canada Steel, Limited, 16 St. Peter Street, and for masonry to E. Belanger. Tenders will be called shortly for roofing, plastering, painting, heating, plumbing and electrical work.

Rothesay, N. B.
The Consolidated School Board have let the general contract for the erection of a school to W. H. Henderson, Rothesay, and the masonry contract to James Sproule, 281 Princess Street, St. John, N. B. Estimated cost, $70,000.

Scarboro Junction, Ont.
In connection with the addition to the school in Section No. 10, the contract for heating and plumbing has been let to Paget & Hay, Agincourt. Plastering, painting and iron work not yet awarded.

St. Catharines, Ont.
In connection with the Citadel now being erected on Geneva Street for the Salvation Army, the masonry contract has been let to Rymer Bros., 33 Dacotah Street, and the carpentry contract to C. M. Darker, 92 Welland Street.

Thorold, Ont.
The following contracts have been let for alterations and additions to a school: masonry and plastering, J. Nichol; painting, Grenville Bros., Thorold; carpentry, John Wilson, Merriton, Ont.; heating and lavatories, O'Gormon & Hemphill, 39 Geneva Street, St. Catharines.

Three Rivers, Que.
The general contract for the erection of an addition to the College for the Brothers of the Christian School has been awarded to J. H. Giroux, 8 St. Oliver Street, and the contract for plumbing, heating, metal work and ventilation to Dechene & Company, 106 Des Forges Street. Approximate cost, $75,000.

Valbryant, Que.
The contract for roofing the church now being built has been let to Joseph Guerin, Scott.

Whitby, Ont.
In connection with alterations and additions to a school, the contract for carpentry has been let to the general contractor, Joseph Pearson, Whitby, and for heating and plumbing to J. McIntyre, Whitby.

In connection with the school in course of erection, the general, carpentry, plastering and painting contracts have been awarded to Joseph Pearson, Whitby, and the heating and plumbing contract to J. McIntyre.

Business Buildings and Industrial Plants

Barrie, Ont.
H. D. Minnikin, 227 Elizabeth Street, has commenced razing old buildings on Bayfield Street, preparatory to erecting undertaking parlours and apartments. Estimated cost, $5,000. Owner will do work himself.

Chatham, Ont.
The stores to be erected on William Street for Fred Bates will be built by day labor. Approximate cost, $13,000.

The erection of a shell factory is being considered by the Maritime Foundry Company, Water Street. Estimated cost, $40,000. Manager, Frank McNaught.

Hay Township, Ont.
S. Bell, Blind Line, Hay Township, has commenced the erection of farm buildings, estimated to cost $3,000. Frame construction, concrete and stone foundation, shingle roofing.

Kingston, Ont.
Work has been started by day labor on the erection of a planing and saw mill for S. Anglin & Company, Wellington Street. Approximate cost, $4,000.

La Tuque, Que.
Work has been started by day labor on the erection of a theatre, estimated to cost $10,000. Frame and steel construction. Architect, L. Auger, 36 St. John Street, Levis.

Levis, Que.
Plans for a store and residence to be erected on Commercial Street for Charles Gastonguay are being prepared by Talbot & Dionne, 14 St. Joseph Street, Quebec. Estimated cost, $6,000.

Molesworth, Que.
The Makamik Sawmill Company, Makamik, Que., have commenced the erection of a sawmill, estimated to cost $6,000. Work by day labor.

Montreal, Que.
Work has been started on the erection of a store at 41 McGill College Avenue by L. P. Mathys, 333 Viger Avenue. Approximate cost, $4,000.

Prince Albert, Sask.
Plans are being prepared for two stores to be erected on Central Avenue for H. B. Boyes, 1756 Nelson Street, Vancouver, B. C. Architect, J. M. Morrison, Masonic Temple.

Quebec, Que.
Tenders will be called for shortly on the erection of a grand stand on the Exhibition grounds. Architects, Tanguay & Lebon, 20 d'Aguillon Street. Approximate cost, $25,000.

Regina, Sask.
Tenders are being received on the erection of an office and warehouse building for the Robert Simpson Company, Queen and Yonge Street, Toronto, Ont. Concrete, brick and steel construction. Estimated cost, $150,000.

Toronto, Ont.
Plans have been drawn for a warehouse on Symes Road for Gunns Limited, Gunns Road, at an estimated cost of $6,000. Corrugated iron construction. Work by day labor.

Usborne Township, Ont.
S. Hicks, Exeter, Ont., is erecting farm buildings, estimated to cost $3,000. Brick construction, stone and concrete foundation, shingle roofing.

Welland, Ont.
S. L. Lambert, 56 Main Street N., has commenced the erection of a wholesale grocery warehouse, estimated to cost $10,000. All work will be done by owner.

CONTRACTS AWARDED

Brantford, Ont.
The following contract have been let for the erection of a store at Colborne and Queen Streets for the Brethour Estate:—general contract, tile and concrete work, Schultz Bros. & Company, Limited, Albion Street; ornamental iron work, Canada Wire & Iron Company, Limited, Hamilton; steel, Hamilton Bridge Works, Hamilton; roofing, Turnbull & Cutliffe Company, 50 Colborne Street.

Dorval, Que.
The Dorval Jockey Club have let the contract for the erection of a betting booth at the Race Track to Louis Beaudry, 2420 Hutchison Street. Approximate cost, $6,000.

Hamilton, Ont.
The following contracts have been let for the erection of a factory on Burlington Street for the Dominion Steel Metal Company, Lister Building:—masonry, Brayley & Nicholson, 155 Gibson Avenue; steel, Hamilton Bridge Works, Bay Street; roofing, Thomas Drouin & Son, 22 McNab Street. Other work will be done by owners.

The contract for plumbing at the warehouse in course of erection at 73 Robert Street for Takefman & Goldblatt has been awarded to the Clyde Plumbing Company, 196 York Street. Roofing, painting and electrical work will be done by the general contractor, M. Levy, 215 Park Street W.

The contract for foundations for the factory to be built on Hughson Street for the T. Eaton Company has been let to Christman & Company, Hamilton, and for the steel work to the Hamilton Bridge Company. Tenders have been received for all other trades. Estimated cost, $150,000.

Montreal, Que.
The general contract for alterations and additions to the factory of the Canadian Consolidated Rubber Company, 950 Notre Dame Street E., has been let to G. M. Martin & Company, 399 Decarie Boulevard. Work has been commenced. Stone construction, concrete foundation, felt and gravel roofing.

The following contracts have been let in connection with the stables in course of erection for J. M. Aird, 165 St. Urbain Street:—metal sash, Steel & Radiation Limited, 304 University St.; stable fittings, Beatty Bros., St. George Street, Fergus, Ont.; heating, General Fire Extinguisher Company, 374 Beaumont Avenue; electrical work, Montreal

Electric Company, Limited, 425 St. James Street.

Quebec, Que.
In connection with the station in course of erection on St. Peter Street, the contract for painting has been let to O. Lachance, 25 Eden Street, Levis, and for electrical work to Vandry & Matte, St. John Street, Quebec. Plastering not let.

Red Deer, Alta.
The general contract for the erection of a grocery warehouse for Nash Bros., Minneapolis, Minn., has been let to Baird & McKenzie, North Red River. Approximate cost, $14,200.

St. Catharines, Ont.
The Nash Realty Company, St. Paul Street, have let a contract for the erection of stores on Queen Street to F. Hoare. Estimated cost, $8,000.

A contract for the erection of a number of stores on Queen Street has been let by A. E. Nicholson, Queen Street, to Newman Bros., 75 St. Paul Street. Approximate cost, $9,500.

In connection with the picture theatre being built on James Street for J. & J. Sullivan, Church Street, the masonry and carpentry contracts have been let to Newman Bros., 75 St. Paul Street, the contract for painting to Leach & Jones, 46 James Street, and for heating and plumbing to O'Gorman & Hemphill, 39 Geneva Street.

Timmins, Ont.
F. W. Reed, Timmins, will receive tenders until August 10th for heating and plumbing in connection with the business block in course of erection. Architects, Angus & Angus, Angus Block, North Bay.

Toronto, Ont.
In connection with the office building in course of erection on University Avenue for the Provincial Hydro-Electric Commissioners the heating contract has been let to the G. E. B. Grinter Company, Limited, 26 West Market Square, Guelph.

A. M. Chapman, 176 Danforth Avenue, is building a garage, and has let the contract for steel work to McGregor & McIntyre, Shaw Street. Approximate cost, $5,000.

H. T. Hunter, 79 Adelaide Street E., has let the contract for the construction of a garage to R. Cummings, 1002 Lumsden Building. Brick construction, felt and gravel roofing. Estimated cost $5,000.

Walkerville, Ont.
Work has been started on the erection of a factory for the Dominion Stamping Company. The contract for steel work and roofing has been let to the Canadian Bridge Company, Walkerville, and the painting contract to C. M. Bennett.

Winnipeg, Man.
The general contract for alterations and additions to the Criterion Hotel has been let to the Standard Construction Company, 1004 Union Trust Building. Estimated cost, $5,000.

The following contracts have been let in connection with the business block in course of erection at Portage and Garry Streets for Leon Honnorat:—ornamental iron and steel work, Western Steel & Iron Company, Limited, Elmwood; roofing, Metal Shingle & Siding Company of Manitoba, Limited, 677 Notre Dame Avenue; marble and tile work, Missisquoi Lantz Company, Limited, 726 Somerset Building; elevator, Gurney Elevator Company.

Residences

Barrie, Ont.
W. C. Thompson, 15 Owen Street, has prepared plans for a residence to be erected on Bradford Street, at an approximate cost of $4,000.

Work on the erection of a residence on Toronto Street has been commenced by W. C. Thompson, 15 Owen Street. Estimated cost, $3,000.

Halifax, N. S.
Plans are being prepared for a residence to be erected on Lilac Street by the Eastern Investment Corporation, Cragg Building, Barrington Street. Tenders for heating, plumbing and electrical work will be called shortly. Approximate cost, $6,000.

Work has been started on the erection of a residence on Jennings Street and of another on Vernon Street by the Eastern Investment Corporation, Cragg Building, Barrington Street. Estimated cost, $5,000 and $6,000 respectively.

Hamilton, Ont.
Tenders will be called shortly on the erection of a residence on Markland Street for J. Sifton, City Hall. Estimated cost, $8,000. Architects, Watt & Blackwell, Lister Chambers.

Plans have been drawn for two residences to be built on Analon Place by MacKay Bros., Lister Building. Brick construction, concrete foundation, shingle roofing. Approximate cost, $2,200 each.

MacKay Bros., Lister Building, have had plans prepared for a residence to be erected on St. Clair Avenue at an estimated cost of $3,000. Contracts will be let for plastering, painting, heating, plumbing and electrical work.

Hensall, Ont.
The erection of a residence is being considered by Alexander Buchanan. Frame and white brick construction. Estimated cost, $3,200.

Levis, Que.
Joseph Leblond, Commercial Street, is building a residence and drug store at Commercial and Fraser Streets by day labor. Approximate cost, $8,000.

Montreal, Que.
Ernest Pepin, 129 Marlowe Street, has commenced the erection of a residence estimated to cost $4,000.

Work has been started on the erection of three flats by George Smith, 519 Papineau Avenue. Estimated cost, $6,500.

North Bay, Ont.
Adam Torrance, 26 Second Avenue E., is receiving tenders on the erection of a residence on Bloem Street. Architects, Angus & Angus, Angus Block. Artificial stone and brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

Ottawa, Ont.
Plans of five residences to be built on Melrose Street are being prepared by Foster & Marks, 11 Irving Avenue. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $8,000.

Work has been commenced by John Wilson, Wellington Street, on the erection of a residence on Bethany Street, at an approximate cost of $5,000. Brick veneer construction, stone foundation, shingle roofing.

Toronto, Ont.
Tenders are now open for the erection of a number of houses in the East End for the Reliance Building Corporation, 70 King Street E. Plans and specifications with the Architect, W. H. Martin, 70 King Street E.

R. Liddell, 155 Lippincott Street, has had plans prepared for a pair of residences estimated to cost $4,800. Brick construction, shingle, felt and gravel roofing.

In connection with the residences being built on Coleman Street by J. Stanhope, 62 Balfour Street, tenders are being received on heating, plastering, electrical work and painting.

The contract for plumbing at the residences in course of erection on Coleman Street for J. Stanhope, 62 Balfour Street, has been let to George Youlet, 261 Booth Avenue.

Work has been commenced on the erection of a residence at 15 Ingham Avenue for F. Hedges, 17 Ingham Avenue. Smaller trades will be let. Brick construction, shingle roofing. Estimated cost, $5,000.

Plans have been drawn for a residence to be built on Garden Avenue by J. D. Naylor, 110 Glenholme Street, at an estimated cost of $3,500. Smaller trades will be let. Brick construction, shingle roofing.

J. McCallum, 150 Cortleigh Boulevard, has had plans prepared for a residence, estimated to cost $3,000. Brick construction, shingle roofing.

Tenders on the installation of plumbing and sanitary conveniences in a number of houses will be received until August 17th by the Board of Control. Plans at office of the Health Department, City Hall.

CONTRACTS AWARDED

Aylmer, Ont.
The contract for the construction of a residence for Mrs. White has been let to C. M. Smith. Approximate cost, $3,500.

Centreville, Ont.
Work has been commenced on the erection of a residence for the Principal of the Public School, William Fenton. The contract for masonry has been let to George Rath, Preston.

Galt, Ont.
The Getty & Scott Shoe Company, 109 Water Street N., have let the general contract for the erection of an addition to their factory to Thomas Hancock, Galt. White brick construction.

Guelph, Ont.
In connection with the residence built on College Heights for Miss M. E. Murdock, the contract for carpentry has been let to D. Scroggie, care of E. A. Mahoney, Telephone Building.

Halifax, N. S.
In connection with the residences erected on Vernon and LeMarchant Streets for the Eastern Investment Corporation, Cragg Building, Barrington Street, the heating contracts have been let to Longard Bros., 213 Hollis Street, the contract for plumbing to W. S.

Craigg, 316 Upper Water Street, and for electrical work to J. Starrs Son & Company, Limited, Granville Street.

The following contracts have been let in connection with the flats in course of erection on LeMarchant Street for G. F. King, Francklyn Street:—masonry and carpentry, J. W. Keddy, 138 Cunard St.; roofing, W. McFateridge, Water Street; plastering, J. Foley, 29 Allen Street; painting, David Roche, 238 Argyle St.; heating and plumbing, G. H. Kinsman, 72 Cornwallis Street; electrical work, John Starr, Son & Company, Limited, Granville Street; interior fittings, J. W. Keddy, 138 Cunard Street.

Hamilton, Ont.

The general, masonry, carpentry and roofing contracts for the erection of a residence for E. Condon, 61 Leeming Street, have been awarded to C. G. Hudson, 10 Edinburgh Street. Approximate cost, $3,500.

Plans have been prepared for a residence to be erected on Kensington Avenue for E. Condon, 61 Leeming Street. The general, carpentry and roofing contracts have been awarded to C. G. Hudson, 10 Edinburgh Street, the contract for masonry to Klingbell & Jevons, 22 Rosemount Street, and for heating and plumbing to H. Barnes, 23 Fife Street. Estimated cost, $3,500.

Inglewood, Ont.

The following contracts have been awarded in connection with the residence in course of erection for J. M. Scott:—brick work and plastering, J. Hunt, Inglewood; carpentry, J. Daytons, Inglewood; heating, A. Sprat & Sons, Inglewood.

Levis, Que.

In connection with the residence in course of erection on Wolfe Street for Joseph Samson, the masonry, carpentry, roofing and plastering contracts have been let to the general contractor, J. Blais, Levis, the painting contract to M. Guay, 50 Carrier Street, and the heating, plumbing and electrical contracts to J. B. A. Lachance, 392 St. Francois Street, Quebec.

Montreal. Que.

The following contracts have been let for the erection of a residence at 25 Fairmount Street E., for the School Board of Infant Jesu Parish:—general contract, masonry and carpentry, E. A. D. Boileau, 1485 St. Andre Street; steel, Structural Steel Company, Limited, New Birks Building; roofing, M. Chouinard, 751 Adam Street; painting, Antoine Lussier; heating and plumbing, N. Ouellette & Fils, 719 Colonial Avenue; electrical work, J. A. St. Amour, 2171 St. Denis Street. Plastering not let.

In connection with the residence built at Grosvenor Street and Westmount Boulevard for the Estate of Jonathan Brown, 1050 Dorchester Street W., the roofing contract has been let to Richardson, Simard & Company, 745 Clarke St., the heating and plumbing contract to Hickey & Aubut, 93 Dominion Street, the contract for tiling to the Walker Hardware Company, Limited, 252 St. James Street, and for plastering to A. K. Hutchison, New Birks Building.

Ottawa, Ont.

E. W. Foster, 80 Spadina Avenue, has let the following contracts in connection with the residence in course of erection on Carruthers Street:—plastering, H. Lethbridge, Westboro; heating, J. Cameron, 488 Lewis Street; plumbing, W. Lethbridge, First Avenue; electrical work, Dominion Electric Construction Company, 417 Sparks Street.

Work has been started on the erection of a residence on Murray Street for A. Levinson, 217 Somerset Street. The contract for plastering has been let to Peter Boply, Heney Street, the heating and plumbing contract to J. T. Blyth, Frank Street, and the wiring contract to the Rideau Electric Company, 128 Bank St.

In connection with the residence being built on Allan Street by James Brownlee, 11 Clemow Avenue, the contract for heating and plumbing has been let to J. Gervin, Bank and Sunnyside Streets, and for electrical work to H. L. Allan, 377 Somerset Street.

Work has been commenced on the erection of a residence on Sunnyside St. for B. A. Grison, 89 Fentiman Street. The contract for heating and plumbing has been let to J. P. Band, 775 Bank St., and for electrical work to H. L. Allan, 377 Somerset Street.

Quebec, Que.

In connection with the residence erected for Eugene Dube, 163 St. Olivier St., the roofing contract has been let to O. Barbeau, 154 Franklin Street, the contract for painting to J. M. Tardivel, 4 Abraham Hill, and for heating, plumbing and electrical work to E. T. Moreau, 176 Abraham Hill.

In connection with the residence being built on Aberdeen Street by Leon Nadeau, 105 Franklin Street, the roofing contract has been awarded to O. Barbeau, 154 Franklin Street, the contract for plastering to J. B. Verret & Fils, 190 Third Avenue, Limoilou, and for heating, plumbing and electrical work to R. Chiquette, 210 Queen Street.

Raleigh Township, Ont.

In connection with the residence erected for J. B. Rhodes, Chatham, P. Q., the contract for plastering has been let to Celesta Blond, 178 St. Joseph Street, Chatham, the heating, plumbing and electrical contracts to Robert Mitchell, 185 King Street W., Chatham, and the painting contract to Fred Phelps, 7 Linden Street, Chatham.

St. Catharines, Ont.

The general contract for the erection of a residence for F. N. Hara, College Street, has been let to Newman Bros., 75 St. Paul Street, the carpentry contract to C. F. Monk, Wilson Street, and the painting contract to Leach & Jones, 46 James Street. Approximate cost, $12,000.

St. Hyacinthe, Que.

The following contracts have been let in connection with the residence in course of erection on Girais Street for J. A. Boisseau:—masonry, J. P. Desjardins; roofing and ventilating, Daniel & St. Jean, 236 Cascades Street; painting and glazing, Jules Gingras, 80 Cascades Street; heating and plumbing, A. Blondin & Cie, 115 Cascades Street; plastering, A. Blanchard; fire escapes, Montreal Architectural Iron Works Company, 157 Prince Street, Montreal. Tile work not let.

Stratford, Ont.

In connection with the residence in course of erection at 26 Centre Street for G. F. Heideman, City Hall, the following contracts have been let:—general and carpentry, G. Faulk, 197 Hibernia Street; masonry, Harry Thorne, Avondale and Huron Streets; plastering, W.Soeder, 210 Huron Street; heating, McDonald & Henry, 11 Ontario Street; plumbing, Classic Sanitary & Heating Company, 164 St. Patrick; electrical work, Bennington & Young, 110 Ontario Street.

Toronto, Ont.

In connection with the residences built on Langford Avenue by Holmes & Anderson, 275 Jones Avenue, the plumbing contract has been let to R. J. Ritchie, 851 Logan Avenue, and the plastering contract to White Bros., 55 Hunter St.

A residence is being built at 94 Neville Park Boulevard by H. B. Jackson, 323 Beech Avenue, at an estimated cost of $4,000. Smaller trades will be sub-let. Owner's name withheld.

The contract for plastering at the residence in course of erection on Pine Crescent for J. A. Stewart, 81 Wheeler Avenue has been let to Halwell & Kilsby, 41 Pickering Street, and the plumbing and heating contract to Stratton & Cork, 314 Lee Avenue.

In connection with the residence built at 60 Neville Park Boulevard by A. Crawford, the heating, plumbing and electrical contracts have been let to Hillier & Company, 2190 Queen Street E., the contract for plastering to T. Wilay, 4 Elmer Avenue, and for painting to G. R. Stacey, 130 Mutual Street.

The following contracts have been awarded in connection with the apartments built by A. McLeod, 47 Benalmond Street:—plumbing, E. R. Restall, 90 Scarborough Road; heating, S. W. Schulkins, 932 College Street; electrical work, G. H. Armor, 21 Ferndale Avenue; plastering, H. Hill, 16 Lawlor Avenue.

E. Churchill, 3 Orchard Boulevard, is erecting a residence at 10 Neville Park Boulevard for N. E. Shier, 900 Queen Street E. The contract for plastering has been awarded to W. Churchill, 42 Edgewood Avenue. Approximate cost, $5,000.

Power Plants, Electricity and Telephones

Ailsa Craig, Ont.

The hydro-electric system will be installed by the Hydro-Electric Commission of Ontario, Continental Life Building, Toronto. Engineer, J. H. Castor. Approximate cost, $7,728.

Athens, Ont.

The installation of an electric light and power system is contemplated by the Town Council. Clerk, A. M Lee.

British Columbia Province

The British Columbia Telephone Company, 555 Seymour Street, Vancouver, have commenced extensions to their system in the Lower Fraser Valley. Approximate cost, $70,000.

Elizabethtown Township, Ont.

The electric lighting system is being installed by the Electric Commission. Manager, E. J. Phillips. Approximate cost, $6,000.

Harriston, Ont.

A by law has been carried providing for the installation of a hydro-electric

Tenders and For Sale Department

TENDERS

Sealed tenders will be received by the undersigned up to noon on **Monday, August 16th,** for the construction of a Municipal Drain in the Township of Minto, known as Drain No. 6.

The drain is about 16,000 feet long and contains approximately 12,500 yards of excavation.

Profile and specifications can be seen at the office of the undersigned.

The lowest or any tender not necessarily accepted.

W. D. McLELLAN,
31-32 Clerk of Minto.

Bridge Notice

Sealed tenders marked Tender for Dismantling the St. John Suspension Bridge will be received at the New Brunswick Provincial Department of Public Works, Fredericton, until **Wednesday, 18th day of August, 1915**, at noon, for dismantling the old "Suspension Bridge" at St. John, N. B., according to Specifications to be seen at the following: Provincial Department of Public Works, Fredericton, N. B., Provincial Government Rooms, St. John, N. B., the offices of the Structural Engineering Company, Limited, 503 to 507 New Birks Building, Montreal, P. Q.

Each tender must be accompanied by a certified Bank Cheque or Cash for an amount equal to five per cent. of the tender, which will be forfeited if the party tendering declines to enter into contract when called upon. Such certified Bank Cheque or Cash will be returned to the parties whose tenders are not accepted, but with the party to whom the contract is awarded, it shall be retained until the final completion of the contract and its acceptance by the Department. Not obliged to accept lowest or any tender.

JOHN MORRISSY,
Minister of Public Works.

Department of Public Works,
Fredericton, N.B., July 29th, 1915. 31

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Tuesday, August 17th, 1915

For All Trades

For Enlargement of Eglinton Public School on Eglinton Avenue

Also

Heat Regulators and Sundry Trades in other Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by surety companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
31 Secretary-Treasurer.

WANTED

Double deck iron cars, suitable for drying bricks in tunnels. Apply Box No. 224, Contract Record, Toronto. 30-31

CITY OF REGINA

Waterworks Department

Sealed tenders will be received by the City Commissioners up till noon, **Monday, September 6th, 1915**, for the supply, delivery and erection of a 7,000,000 gallon Pumping unit at the City Power House, Regina, Sask.

Specifications and other information may be obtained from the office of the undersigned. The City does not bind itself to accept the lowest or any tender.

J. M. MACKAY,
Superintendent of Waterworks.
July 22nd, 1915. 30-31

COUNTY OF BRANT

Sealed tenders clearly endorsed on the outside "Tender for Puttown Bridge Abutments," will be received by the Counties of Oxford and Brant up to 12 o'clock noon, on **Saturday, August 14th, 1915**, addressed to the County Clerk, County Building, Brantford.

(a) For Reinforced Concrete Abutments, and alternatively

(b) For Solid Concrete Abutments.

Tenders for either class must be on the prescribed forms and accompanied by a marked cheque for 5 per cent. of the amount of the tender made payable to the Treasurer of the County of Brant. Plans and specifications may be seen at the office of the County Engineer, from whom tender forms may be had, Room 4 Temple Building, Brantford.

ALAN MAIR JACKSON,
31-32 County Engineer.

Tenders for Wrecking Buildings

Sealed tenders will be received, addressed to the Chairman of the Finance Committee, City Buildings, St. Catharines, up to 5 o'clock p.m. of **Tuesday, August 24th, 1915**, for the wrecking and removal of the following buildings on the right-of-way to the St. Paul Street Bridge.

3 Blocks of Brick Stores.
2 Brick Residences.
1 Large Stone Residence.
Barns and Sheds.

An alternative tender will also be received for the salvage of the lot of the I. O. O. F. property, together with their building.

Specifications and information regarding the work may be obtained at the office of the City Engineer.

Tenders will be received for each building separately or for all in bulk. A marked cheque for Fifty dollars must accompany each tender. The City does not bind itself to accept the highest or any tender.

W. P. NEAR,
31-32 City Engineer.

Paving Tenders

Sealed tenders addressed to the undersigned will be received up to 8 o'clock p.m., **August 9th, 1915**, for paving Canal Street East, Dunnville, Ont., with either Rocmac, Tarvia, Westrumite or Oil Bound Macadam. Contractors will please submit specifications, and the Council reserves the right to select the paving most suitable.

Plans may be seen at the Town Engineer's Office on and after August 2nd, 1915.

No tender necessarily accepted.

J. W. HOLMES,
31 Town Clerk.

Power Plants, Electricity and Telephones

(Continued from page 53)

system. Town Engineer, John Patterson.

Saskatchewan Province

The following rural telephone companies have been authorized to borrow money for the construction of their systems:—Cut Knife, $12,000, Secretary, W. W. Johnston, Cut Knife; Ernscliffe, $6,000, J. F. Middlemiss, Wolseley; Glenrose, $10,000, R. J. Howard, Glenrose; Hielier, $12,000, R. Howe, Stoughton; Kansas, $6,000, J. R. Funk, Drake; Lockwood, $10,000, M. H. Waldron, Lockwood; Lovat, $2,500, A. Parley, Lovat; Mair, $9,000, J. C. Clark, Mair; Montgomery, $4,500, C. A. Ingham, Kennedy; Narrow Lake, $14,000, M. J. Stephenson, Wilkie; North Redvers, $11,000, G. M. McKenzie, Redvers; O. K., $3,500, H. McManus, Colgate; Paswegin, $3,500, F. Gillespie, Paswegin; Renown, $5,500, G. McKay, Renown; River Ayr, $25,000, J. N. R. Finlayson, Broadview; Ruddell, $5,600, A. E. Steele, Ruddell.

Windsor, Ont.

The City Council are about to call for tenders on the supply of about five miles of copper wire. Clerk, S. Lusted.

CONTRACTS AWARDED

Glenrose, Sask.

The Glenrose Rural Telephone Company, Limited, have let the contract for the construction of their system to Harold Herbert, North Battleford, at $9,350. Contractor is in the market for material for about 44 miles of line.

Montreal, Que.

The contract for the supply of underground cable for the Filtration Plant has been let by the Board of Control to the Northern Electric Company, Limited, 814 Notre Dame Street West.

Casement Contracts

Messrs. B. & S. H. Thompson & Company, Limited, of Montreal, representing the Crittall Casement Company, have secured the contracts for the solid steel casements for the new Montreal Civic Library, and also for the Ross Pavilion of the Royal Victoria Hospital in Montreal.

ESTABLISHED 1886

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What Effect Will the Conflict in the Old World Have Upon the Development of the New?

When the present unhappy conflict in Europe first started, people began to ask each other, How long will the war last? This question has been bandied from one to the other until it has become tiresome. Perhaps there has been some excuse for speculation of the kind, seeing that European wars on such a scale have not been an everyday occurrence in the lives of most of the speculators.

It is significant that people no longer make it a matter of vital concern whether the war will last another six months or another six years. They are beginning to appreciate the hard fact that business cannot be conducted "as usual," and that the stability of their incomes can be maintained only by enterprise and effort. The war, with the conditions attendant upon it, is beginning to sink in deeper, and the elementary questions propounded a year ago are giving place to serious ideas worthy of consideration and discussion. Such an idea is embodied in the caption of this article. The question, which is asked by a reader of The Contract Record, provides food for reflection.

The phenomenal development which this country has witnessed during the last decade has been attributable almost entirely to the ever-increasing stream of immigrants from the Old Country. Almost any western town or city bears out this assertion—Vancouver, the Gateway to the Pacific; Calgary, the cow-town of a decade since; Winnipeg, a generation or so ago little more than a trading post; Edmonton, Saskatoon, and many others. Whether we like it or not, we must consider the hard, cold fact that the stream of immigration is cut off—for the present, at any rate—and that we are now face to face with the situation of **holding our own.**

It is a gratifying reflection that so far, thanks largely to the enterprise of the manufacturing interests and the extent to which they have been able to cope with emergency war orders on an unparalleled scale, we **have** been able to hold our own. We find business actually picking up in the manufacturing centres, owing to the receipt of these large war orders from Britain and her allies. Railway earnings are improving, and the money market is featured by a gradual strengthening of rates as the crop-moving period approaches. Canadian steel mills are getting a good deal of business from the Old Country, for steel and iron products, and it is believed that Canada is finding a permanent place in the British market.

There is no doubt whatever that the situation in Canada thus far has been saved by the country's supreme confidence, not only in the Empire, but in itself. Confidence, then, business enterprise, and manufacturing supremacy, are the three pillars upon which the country's prosperity must be stayed during the period of the war. And what then? Some would say the Deluge, but we think not.

There are those who, in discussing the prospects of the country upon the termination of hostilities, will point to the millions that have fallen, and to the unprecedented destruction in the ravaged cities of France and Belgium. They will tell you that every mechanic will find a place—and a good place—in Europe, and that the Old World will supersede the New in constructional attraction.

With this we are not in accord. We may be sure that for long enough after the declaration of peace, finances will not be forthcoming so readily for the rebuilding of half a continent, and that much of the restoration will come about rather as a sort of evolution than as a sudden enterprise. Moreover, in the matter of such principles we may learn much from history. It is a fact that the greatest periods of colonial expansion followed immediately upon the great wars of the eighteenth and nineteenth centuries. There are those of us who can recall the impetus given to immigration by the Franco-Prussion war, and later by the South African war.

For our own part, we look upon the present troublous time as affording Canada an opportunity of self-examination and preparation. It is a time when all matters appertaining to public and private administration should be overhauled, when loopholes should be detected, and false economies exposed, when the affairs of the State should be placed upon a sure foundation, and the affairs of the individual strengthened and purified.

Canada has a great future, and the prospects of the country are enhanced rather than diminished by the losses sustained in the Old World.

Montreal's Far-Famed Water-Works System

READERS of the Contract Record are aware that the city of Montreal is carrying out an extensive scheme for improving the waterworks, enlarging the aqueduct, and constructing a hydro-electric plant. It is proposed to revise the original plans and, with the approval of Messrs. Hering and Fuller, lonsulting engineers, of New York, to spend a further large sum on the scheme. This decision has resulted in some particularly trenchant criticism by Mr. J. A. Jamieson, who with Mr. R. S. Lea and Mr. G. R. Heckle reported on the water conduit when there was a serious break in the pipe, in December, 1913, causing great inconvenience to the city.

Mr Jamieson argues strongly in favor of no further expenditure being made until the project has been studied and reported on by thoroughly qualified engineers, and in this he is supported by a resolution of the Canadian Society of Civil Engineers. Controller Cote, who is responsible for the engineering department of the city, has replied in no less vigorous tones to Mr. Jamieson, and intimates that it is intended to carry out the scheme notwithstanding the "unjust criticism" which has been made.

In his "open letter," Mr. Jamieson declares that the information gathered by himself and his colleagues indicates that the aqueduct power development was not an economic proposition, and that the excessive cost would impose a heavy burden on the city from which an adequate return in power development could not possibly be obtained. "It was these facts which convinced us, after mature deliberation, that it was our duty to make the recommendation that a commission of engineers should be immediately appointed to investigate the whole aqueduct power project with the conviction that a modification of the whole scheme might be made which would save the city a large sum and also heavy expense in litigation with the contractors." The proposed retaining walls are, he says, entirely unnecessary, either for the aqueduct or the support of the conduit, as the banks can be sloped in accordance with the usual practice in canal or head race construction, thus saving about $2,000,000. Mr. Jamieson estimates the total cost to be $7,500,000 for a development, estimated by Mr. Janin, the chief civic engineer, to be capable of producing 10,000 horse power. He believes, however, that owing to climatic conditions, only 7,500 horse power can be developed, and on this basis the cost will equal $1,000 per horse power, or over eight times the average cost of hydro-electric development in the vicinity of Montreal, including the transmission line to deliver the current in the city limits. "This is an unprecedented cost for a power development in any part of the world, and particularly for a hydraulic development which will require an auxiliary steam plant, or hydro-electric standby equal to nearly 100 per cent. of its normal capacity."

In reference to representations made to the committee of aldermen on their recent visit to the aqueduct, "that the retaining walls were urgently required to prevent another failure in the conduit," Mr. Jamieson has a very full knowledge of the condition of the conduit and the banks of the aqueduct in which it is embedded, and cannot find any justification for this claim. While the conduit is not of the best design, and was not nearly as heavily reinforced with steel as it should have been when constructed for the purpose intended, it is now, after the repairs made to it during 1914, quite safe if left undisturbed by further overload or excavation too close to it.

Mr. Cote points out in reply that the scheme has already been reported on by many eminent engineers, and insists that it is a good and economical plan, and that no further examination is necessary. The scheme will provide the necessary power for pumping and also for lighting the city streets. The additional cost is unavoidable, owing to higher prices and other causes. The annual outlay of pumping and lighting is estimated at $495,000, representing at 5 per cent. a capitalization of $9,900,000, a "sum very much in excess of the $7,000,000 which the development would cost and leaving a very substantial margin for installation and transmission charges, and naturally the municipality is in possession of its own privileges at the lesser cost." Mr. Cote declares that 10,000 horse power will be developed, and that there is no danger from frazil ice such as is feared by Mr. Jamieson.

The reason for the criticism was the extra appropriation to "strengthen the original design of the concrete retaining walls forming the sides of the aqueduct, and this despite the fact that in your letter you criticize the construction of the lateral conduit as being too weak. You evidently would like to see the walls built in the lightest manner, and not strengthened, as they are to be, to meet the most exacting criticism of engineering science." With regard to the criticism that sloped embankments should have been substituted for the semi-vertical concrete walls adopted for the lining of the aqueduct sides, the experience with the sloping banks of the old aqueduct in the fifty years of its existence showed they were a source of considerable trouble and expense through the displacing of the rip-rap facing at the water line from ice each winter, and some more modern method of protecting the water line, such as concrete facing, if introduced would have entailed much added cost. Then, again, banks at a minimum slope of 2 to 1 would have necessitated an extra width of land of about 54 feet, to be expropriated, which at an average price of 50 cents per foot would have entailed an extra cost of $27 per lineal foot of aqueduct, or $459,000 on the 17,000 feet comprising the lower or first earth section alone. Furthermore, the velocity of flow of the aqueduct would have greatly diminished with sloped banks, as compared to the concrete side walls. The modifications made in the specifications for definite design of the test wall were to meet local conditions and the design as now decided upon is the result of this study.

Mr. Jamieson, concludes Mr. Cote, tried in 1914 to persistently convince him that the conduit was unsafe, that the design and construction were defective, and that it was absolutely necessary to build a new one, but he was glad to find out from Mr. Jamieson's letter that the conduit is quite safe if left undisturbed.

Co-Operation of Railways and Municipalities a Pleasing Development

As reported elsewhere in this issue, the Dominion Railway Commission has made a low commodity rate for gravel consigned to municipalities for road-making and highway improvements. The formal order only applies to Western Ontario and is 50 cents a ton for any distance including and up to fifty miles for carload lots. The order, however, will be extended so as to apply to all parts of the province.

The order was practically made by consent. The railway companies had first resented the application for the commodity rate upon the ground that they were applying for a general increase in freight rates east of Lake Superior. However, they yielded to the representations of Sir H. L. Drayton, Chief Commissioner, who appealed to them upon grounds of public policy.

The order is without prejudice to the application of the railways for higher freight rates. The companies, however, are to be commended upon the fair spirit they have evinced in this matter, and the Chief Commissioner has given them full credit in the memorandum made public.

Cases of excessive corrosion of iron and steel bridges are detailed and illustrated in a paper by Frederic H. Fay presented recently before the Engineers' Society of Western Pennsylvania. Badly corroded truss eyebars of steel are pictured, in which a loss of nearly 70 per cent. of the section occurred in the worst case. Casual examination of such structures fails to give a true idea of their condition, as the rust scales were so thick that loss of section could not be detected. Protection by the use of reinforced concrete securely attached to the steel is recommended, also the use of excessive metal section or even extra cover plates in locations particularly exposed to corrosion. The bottom flanges of overhead beams should be treated by the latter method, in the opinion of Mr. Fay. The most noticeable causes of corrosion are given as exposure to locomotive gases, exposure to sea water or surface water leaking through the bridge floor, and over-stress of metal which hastens corrosive action. Brine drippings from refrigeration cars on railroad bridges and coal-tar mixture dropped from wood-block pavement, which removes paint, were also mentioned as agents of corrosion.

Planning on Contract Work

It must be admitted that there are many deficient contracting organizations where adequate attention is given to planning. Such, for example, are some of the very large organizations with ample backing, manned not by men placed there by financiers as actual managers of a business venture, but by hard-headed, shrewd contractors who have risen with or without college education, through the school of hard knocks. Such, also, are some of the very small organizations, where the owner takes but one job at a time and lives on it. In these small organizations, however, there is less likelihood of the separation of the planning and doing functions, though the planning is properly provided for.

Taken in the mass, however, contracting organizations are weak on the planning side. On small jobs the weakness is called ignorance of the contracting "game".; on the big ones, lack of efficient management. Analyzed, however, it will be found that the deficiency is the fundamental one of lack of thinking —of being too busy doing the work to spend any time in anticipating problems and providing in advance for their solution.

Recently two striking instances of brain versus brawn have come to the attention of this journal. Contractors of two types are working side by side on jobs presenting similar difficulties under identical conditions. In the one case the structure being built is of a very complicated nature. The one contract is going ahead in a rapid, orderly way, the men moving about with an assurance which indicates that they know what they are doing and how to do it. In every department of the work the orderliness and vigor of the activity is evident. On the adjoining contract paralysis in certain phases of the work is evident. Here, equipment is lacking; there, materials (though the job has been in progress six months). In another place men have been withdrawn for no apparent reason. The one job looks ship-shape, successful; the other, disorderly, almost hopeless. Even the layman, ignorant of construction methods would declare the one job efficient, the other inefficient. The very atmosphere of the two tells the story. The successful organization is manned by old-time contractors, with a reputation for carrying through difficult jobs successfully. The other is a business venture by financiers knowing nothing of contracting but placing their faith in energetic men whose management is of the brawn rather than of the brain type.

In the other case the adjoining contracts are on railroad grading. In fact, there are half a dozen contractors doing similar work, yet one of them, month after month, gets out one-third more yardage with his steam shovels than any of his competitors. The contractor is noted among his acquaintances as a clear thinker who never tires of developing new methods of attack, who is as "long" on thinking as he is on vigor of execution.

Every contractor and engineer can multiply instances of this sort. There will be those who claim that contract work, on the whole, is conducted quite as efficiently as other lines of business. This journal, however, has indicated its disagreement with these critics and knows that an impartial inquiry will show that its position is correct. As it has pointed out, contracting, fundamentally is more difficult to handle efficiently than a factory. In the latter there is endless repetition of operations capable of being divided into small parts. For this reason it is economical to spend a great deal of time in studying the machines and the methods for each of these operations, for the slight saving on each unit makes a tremendous volume in the aggregate. Furthermore, in factory work operations may readily be supervised closely. On contract work the very opposite conditions obtain. There is comparatively little repetition, and such as there is, is divided into relatively large elements, such as the placing of a whole floor of reinforcement, the erection of thousands of square feet of forms, etc. Again each single manual operation entering into contract work is not often enough repeated to enable it to be standardized with the thoroughness of factory work, while, evidently, supervision is much more difficult. There enters, too, the element of fatigue, far more serious on contract work, because of the rather strenuous character of the manual operations and less serious in factory operation. All of these points tend to make it more difficult to secure as high an efficiency in contract work as in factory operation, and this fact, sensed unconsciously by contractors, has deterred them from the refinement whose merit the factory manager never questions.

A corollary to these observations is that the opportunity for improvement in the efficiency of contract work is still very large. Higher efficiency is to be obtained by increasing the percentage of thinking—of planning—and decreasing the percentage of jobs on which the doing is considered to render thinking impossible.—Engineering Record.

Proposed New Civic Library, Montreal

ONE of the most important buildings of the season in Montreal is the civic library, now in course of erection on Sherbrooke, Montcalm and Beaudry Streets, from plans by Mr. Eugene Payette. The contract was the subject of considerable discussion by the City Council, which awarded it to John Quinlan and Company, Montreal, on the understanding that there was to be no sub-contracting.

The work of putting in the foundations was made a separate contract. There are various sections of the city where the ground forms a somewhat uncertain foundation, owing to its being of a clay nature and quite plastic.

In building operations in these sections it is necessary to make a careful study of the ground underlying the building contemplated, and to design the foundations with due regard to the best engineering practice.

The Municipal Library is located in a section of the city where the construction of foundations is complicated by the character of the ground overlying the rock to a depth of 40 to 50 feet. This ground is clay in its nature, and as its movements cannot always be controlled, it appeared advisable in the case of the Library Building, to eliminate hazards by founding the building on rock and passing through the treacherous clay soil.

When Mr. Payette reached this decision, steps were promptly taken to proceed with building the foundations. The Foundation Company, Limited, of Montreal, completed the work under the direct supervision of the architect. Owing to the fact that the foundations were all underground, the magnitude of the work was not apparent, even to an interested spectator, as the site was very little changed after the completion of the foundation, the greater bulk being concealed entirely underground.

New Civic Library, Montreal, now in course of erection. Architect, Mr. Eugene Payette, Montreal; contractors, Messrs. John Quinlan & Company, Montreal.

In all, sixty-six wells were sunk from surface to rock, and filled with concrete. These wells, if placed end to end, would resemble a round concrete chimney 25,041 feet in height. Each one of these is built on ledge rock, all loose rock having been removed; consequently, when the library is completed there will be no danger of any unsightly cracks ruining the expensive and artistic interior, and there will be no treacherous ground lying between the foundation of the building and rock.

The building is of irregular shape, the main portion being on a site 115 ft. x 115 ft., with the principal entrance on Sherbrooke Street; the extension faces on Montcalm Street, the area being 45 feet by 109 feet. The height of the main section is 62.5 feet. The plans show an admirably planned structure, with plenty of light on all four sides. A large amount of marble is to be used in the construction, and wherever possible Canadian material will be employed. There are to be a basement and three storeys. The base of the building is to be of Stanstead granite and the superstructure of Queenston stone. The floors of the principal building will be of terra-cotta and concrete construction, the latter being the chief material selected. The stairways are of Missisquoi marble, which is also used extensively throughout the library; the roof is to be flat, and tiled.

The main distinguishing hall is approached by a short flight of steps on Sherbrooke Street, and through an artistic entrance, the facade being embellished by ten monolithic columns of polished granite. The basement will contain the boiler room, coal bins, ventilation plant (Acme system), storage, and janitor's apartments, which will be at the rear part of the building. On the ground floor, reached from Montcalm and Beaudry Streets, will be located a reading room for children, 39 ft. x 69 ft.; a bindery, 34 ft. x 38 ft.; stationery room, 36 ft. x 31 ft.; receiving rooms for books; a stock room, 40 ft. x 107 ft., which will be lined with Kittanning brick; and toilet rooms.

The main floor is the principal room, and is so arranged as to give free access from every department. The distributing room is 29 ft. x 64 ft.; the reading room 33 ft. x 110 ft.; and the newspaper room 39 ft. x 52 ft. The reading room is on the left of the entrance, while the newspaper, librarians', cataloguing, and stenographers' rooms are on the right. This section also contains telephone booths, coat rooms, etc. The reading room floor is to be lined with cork tile.

From either side of the vestibule wide galleries lead to a gallery constructed of marble on the next floor, from which is reached the art room, 31 ft. x 74 ft.; Canadian room, 31 ft. x 69 ft.; exhibition room, 31 ft. x 37 ft. It is intended to place collections of interest to Canadians in the Canadian room. The gallery is surmounted by a glass roof. The entire furniture will be of oak. The heating is to be by a hot valve system.

The contract price for the building is $461,000 and for the foundations $65,000.

Application of Stucco to Brick Work

In applying stucco to old brick walls, the most important point is that the old surface must be thoroughly cleaned. If coated with paint, this must be scraped or burned off, and if uncoated the surface must be washed with a solution of muriatic acid mixed in the proportion of one part commercial muriatic acid to five parts of water. The wall should be scrubbed with this solution, then thoroughly cleansed with clean water.

The joints between the brick work should be picked back from the face of the bricks to a depth of ½ in. to ¾ in., so as to form a key for the plaster. Immediately before applying the plaster the surface of the walls should be thoroughly soaked with water, for on account of the porous nature of the brick, water would be absorbed from the plaster, thus injuring its strength, unless the brick were thoroughly saturated beforehand.

Sometimes, instead of applying the cement plaster directly to the brick, metal lath is fastened to the brick and the stucco placed on it. Metal furring strips are attached to plugs driven into the joints of the brick work, and the lath is fastened to these strips. This method of construction is always advisable for covering brick chimneys, so as to prevent cracking due to extreme temperature changes.

In applying stucco to new brick work, the procedure is practically the same as described, except in the matter of cleaning off the surface, though the walls should be brushed to remove any mortar that may have splashed on the surface of the brick, at the time of laying up the wall.

Maintenance of Concrete Pavements

THE following recommendations as to proper methods of maintenance of concrete roads, given by Cement World, are based on a survey of the results of up-to-date practice in various parts of the country:—

(1) The imperfection to be repaired should be thoroughly cleaned by brushing until all loose particles have been removed.

(2) If the imperfection extends through the pavement and exceeds 6 in. in breadth or diameter, the sides should, after cleaning, be painted with cement grout, and the cavity filled with concrete of the same mixture and consistency as was used in building the original pavement. If a replacement, the excavation should be back-filled with gravel, well tamped, and the concrete properly reinforced. The repaired portion should be cured by being kept moist for at least four days, and protected from traffic until thoroughly hardened.

(3) When a hole does not extend through the pavement, but exceeds ½ in. in depth, it should be carefully cleaned and dried, and then painted with hot tar. The hole is then filled with stone. Several sizes should be carried by the repair gang, the object being to use in any given hole a size of stone large enough to reach nearly from the bottom of the hole to the surface, but never to use stone exceeding 2½ in. in diameter. Where large sizes of stone are used, voids should be carefully filled with smaller sized stone and the whole tamped or rolled into place. Hot tar is then poured over the patch, gauging the quantity so that the tar will be absorbed without any large excess.

(4) Holes less than ½ in. deep, cracks less than 1 in. wide, and expansion joints from which the filler has wholly or partly disappeared, should be cleaned, dried, and filled a little above level with hot tar, on the surface of which gravel or granite, from ⅛ in. to ¼ in. in size, should be spread from a shovel.

(5) Refined coal tar should be used, having a specific gravity not less than 1.18 nor more than 1.25 at 77 deg. Fah. The tar should be heated to from 225 deg. Fah. to 250 deg. Fah. at the time of application, and may be applied by means of conical-shaped buckets with openings at apex, or by using a sprinkling can. Sand or screenings graded from ⅛ in. to ¼ in. should be spread over the surface, before the tar has cooled enough to prevent the sand from becoming firmly embedded therein to form a permanent wearing surface.

7,000-Foot Pipe Line Floated to Place in Lake Ontario in Long Sections

Lowered and Placed from Pile Bucks and Connected with Special Submarine Joints by a Diver—Terminus of Line in Large Timber Crib

A sixty-six-inch steel pipe line was recently laid in the bed of Lake Ontario for the discharge from the Rochester sewage-disposal plant by floating it into place in long sections, filling the sections with water, lowering them from pile bucks and connecting them with a special submarine joint. The work is described in The Engineering Record by H. A. Brown, Special Assistant Engineer, Rochester, N.Y.

The discharge line extends from the end of the plant to the shore of Lake Ontario, a distance of 1900 ft., in open trench. From this point the pipe is submerged and laid in a dredged trench, terminating in a timber crib 7000 ft. from shore.

Ready to open valves to fill section with water and sink it.

The straight sections of the pipe are of the lock-bar type, 66 in. in diamater, made of ½-in. steel plate in 30-ft. tapered sections. The pipe for the land section was unloaded on the site of the work. That for the lake section was delivered at a yard on the river, 2 miles away. A shallow beach and a main-line railroad track made the launching of long sections of pipe at the work practically impossible. At the yard the pipe was riveted into lengths of 120 and 160 ft. The shorter lengths were used at the outer end, where the piles would not bear the heavier loading, and near shore, where the wave action would not permit dredging long trenches.

Submarine Joint Simple and Flexible

At the ends of these pieces submarine joints, similar to those used on the intake pipe, at Erie, Pa., were placed. The joint consists of a welded angle and papered ring riveted to one end of the pipe to form the bell, and a flat ring riveted to the other end, with a lead gasket and a loose angle-ring follower to form the spigot. Bolts through the angle rings draw the gasket between the flat ring and the sides and hub of the bell. This gives a tight and slightly flexible joint. A slip joint to take up expansionwas provided where the land and lake sections of the line join.

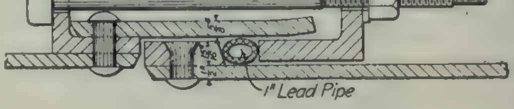
The line ends in a three-way tee, having one 66-in. and two 38-in. outlets. This tee is placed in a crib to protect it from anchors and raise the discharge above the bottom of the lake. The crib is 46 ft. square and 24 ft. high. It is built of 12 x 12-in. timbers, and divided into twenty-five pockets. These were filled with stone, except where occupied by the pipe, and the crib was surrounded with riprap. The sills of the crib are 4 ft. below the bottom of the lake and the top is 26 ft. below low water.

Hydraulic Dredge Digs Trench

An 8-ft. trench was excavated by a hydraulic dredge to allow 2½ ft. of cover over the pipe. No attempt was made to excavate holes for the joints, as it was found to be more satisfactory to do this with a jet as the pipe was laid. In the excavation it was found that the fine sand would stand on a 1:1 slope. Where clay was mixed with the sand the slope was 4:1.

Work started at the crib and progressed toward shore. After the excavation was made the location of the crib was marked on three sides with piles. The crib was towed to position and suspended by cables from two derrick scows, and the pockets were filled with stone. It was then gradually lowered to place.

To lay a section of pipe a buck of four piles was driven at each end of the section. These piles were built up of three 5 x 12-in. timbers, were driven 10 or 12 ft. in the ground and extended 10 ft. above water. They were driven on 14-ft. centres and the tops were drawn to 10-ft. caps to give stiffness. They were capped across the pipe line with round timbers, and the two bents were tied together along the line with 2 x 8-in. plank, on which other plank were laid to form a working platform. On the caps another round timber was set, parallel with and over the line of the pipe. A set of Manilla rope falls was hung from the upper cap on a U-bolt. When the rigging was in place a pipe section, which had been bulkheaded and launched at the yard, was towed to position between the piles, and cables were placed around each end of it and shackled to the lower block of the falls. Valves in the bulkheads were then opened and the pipe was filled with water, after which the tackles were slackened off by hand and the pipe was lowered to place. When near grade a diver descended, removed the bulkheads and directed the work from below. A line from the middle of the pipe extending to the forward pile buck, was held taut as the pipe descended, swinging the pipe endways away from the bell already on the bottom. When at grade this line was slacked and the spigot slipped into the bell. The bolts were entered by the diver, but the nuts were

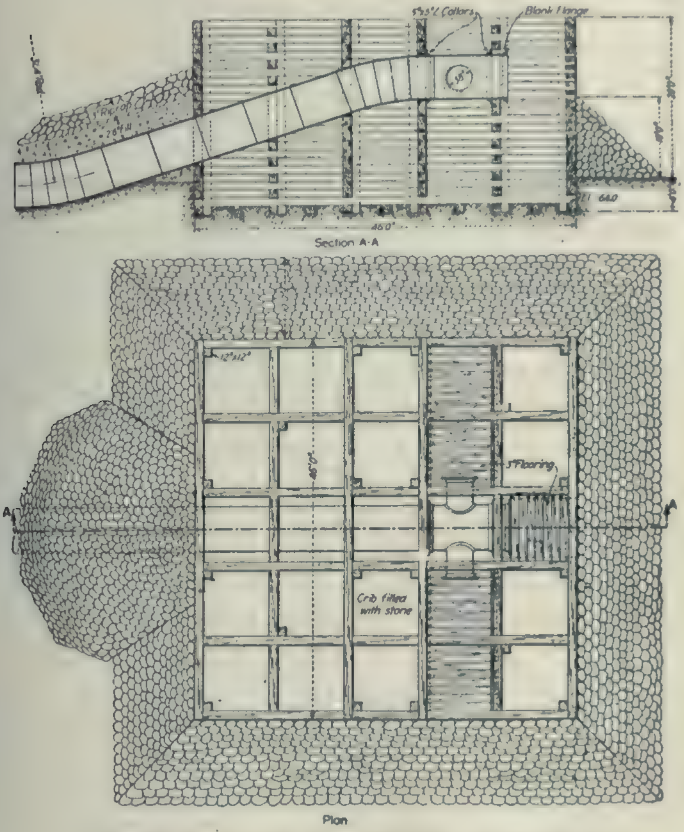


Joint easy to connect under water.

drawn up by men at the surface with a tackle attached to a ratchet wrench.

To permit the removal of all tackle before backfilling, a cable was passed under the free end of each section of pipe and drawn up to the caps with eyebolts. After the backfill had settled these cables were removed and the piles pulled.

The work was done by the T. A. Gillespie Company and completed in fourteen months. The contract price, which included furnishing and laying both the land and lake sections, was $250,000.



Stone-filled crib protects end of discharge from disposal plant.

Paving by Compressed Air

We are indebted to our Australian contemporary Building for the following:—

A German engineer, Herr Wegener, has recently designed a machine for use in streets where the pavement consists of stone cubes. In shape it resembles an ordinary hand ram with two handles which serve as guides. It is worked by compressed air which is generated in a movable compressor plant, the compressor of which is driven by a benzine or benzol motor. The same motor serves for driving the car carrying the plant to and from the place of working. The compressed air is transmitted to the ram by means of india-rubber hoses, having a length of 50 ft. and at a pressure of from 85 lb. to 100 lb. per square inch. The top of the ram contains a valve which is shut or opened by means of a hand lever, and thus regulates the admission of air into a piston with a hollow piston-rod which is contained in the interior of the ram. By pressing down the valves, the piston, by means of the compressed air which enters, is forced down until it rests on the pavement, and by doing so lifts the whole ram. Immediately, however, upon the hand lever being again released, the compressed air which has collected above the piston escapes into the open air by means of an exhaust and the ram falls down upon the pavement.

This fall of the ram can be regulated as required, and its removal from one stone cube to another is very easily effected. The number of strokes to be given with the machine averages 80 per minute. The engine plant is made in three different sizes, for one, two or three rams. For three rams a motor of 18 horse-power is required. The car which carries the plant can travel at the rate of about four miles per hour. Both the motor and the compressor are cooled by means of a cooling pump, for which purpose a separate water car is provided. In addition to the machinery proper, the car contains a small filing bench with a vice, also drums for the hoses. For the smaller plants a motor of from 10 to 12 horsepower is sufficient.

The cost of paving by means of these compressed air machines is about 2½d. for every square metre, or 10.764 square feet. By using crude oil or petrol motors, however, this cost can be still further reduced. With one ram, 1076 square feet of pavement can be easily rammed down in one working day.

Oil Paints for Concrete Floors

INSTANCES are on record where oil-pigment paints have been effectively used to stop the dusting of cement floors brought about by abrasion. If the floor has been freshly laid and is damp, the possibility of lime reaction (saponifying the oil in the paint) may be removed by first treating the surface with a solution of tinted zinc sulphate as a primer.

Boiled linseed oil, sometimes mixed with Chinese wood oil, may be used as the liquid portion of the paint. These oils have a remarkable binding action when applied to a cement surface. When mixed with pigment, they form paints which are eminently suited as first coaters for cement floors. The first coat will dry rapidly and form a dense surface. Over this may be applied a second coat, and, if a high gloss surface is desired, a portion of varnish may be added to this final coat.

In a laboratory built three years ago for experiments in connection with the paint industry, the cement floors were treated in the manner above described, one week after the concrete was in place. The zinc-sulphate primer was used only upon the damp areas. The floors have since been subjected to much abrasion from constant walking and the moving of heavy apparatus. Oils and chemicals of various kinds have come in contact with the floors, and soap and water have been used upon them very often for cleaning purposes. After three years' service, the floors have not dusted and have never required repainting. The paint films are still in good condition. This service record would tend to show that placed Portland cement may be made dust-proof, wear-proof, and highly desirable as a flooring material, by the application of oil paints.

Care must be taken to prevent work from being thrown out of plumb by swelling of lumber in forms. If the forms spring out of place the concrete may flow out and be wasted. At best any springing of the forms will injure the appearance of the surface of the finished structure.

Asphalt: Its Application in Road and Sanitary Work*

By N. Hoskins

THE subject of asphalt and bitumen has been so much discussed recently in the technical press that I almost owe an apology for not allowing the matter to rest. I ask to be excused, however, on the grounds that they have not been fully treated in relation to their use in sanitary work in particular, and the nature of the materials under various conditions is not fully understood.

NOMENCLATURE

The subject cannot be even superficially treated without first differentiating between asphalt and bitumen, their allied compounds and their substitutes. Many of the terms used are very loosely applied, and it is hoped that the "Glossary of Road Terms" recently compiled by Mr. H. Percy Boulnois will be the means of bringing about an understanding among manufacturers and users of these important materials. It is a common practice for the "man in the street" to speak of tar paving as asphalt, or maybe, "ashfelt."

Without claiming originality or attempting to criticise the publication just referred to, the following interpretations are intended to apply to this paper:—

Asphalt.—A general term applying to any and every description of asphalt or crude bitumen.

Rock Asphalt.—Limestone or sandstone naturally impregnated with bitumen.

Lake Asphalt.—Crude bitumen.

Compressed Asphalt.—Pulverized rock asphalt heated and consolidated under pressure.

Mastic Asphalt.—A preparation of rock asphalt and additional bitumen, with or without an admixture of coarse sand or grit.

Artificial Asphalt.—A mixture of pulverized limestone and grit made plastic with bitumen.

Bitumen.—A mixture of hydrocarbons in a solid or viscous state which are wholly soluble in carbon bisulphide and almost insoluble in alcohol.

Maltha.—Crude bitumen in a semi-fluid condition.

Pitch.—The residuum from the distillation of coal tar, wood tar, &c.

Bituminous Mastic.—Any mixture composed of pulverized stone or grit made plastic with or containing pitch or tar products.

Origin of Bitumen.—Many theories have been advanced as to the origin of bitumen in nature. It is so closely allied to petroleum in composition that the formation of one cannot be considered without reference to the other. Parkes' "Chemical Catechism" states "naptha is a fluid and transparent as water; but when exposed to the air it becomes yellow, and then brown; its consistence is increased, and it passes into petroleum. Petroleum is found native in many countries, and by an exposure to the air becomes mineral tar. Mineral tar is also found native which by exposure to the air passes into mineral pitch and maltha. By further induration this passes into asphaltum, which substance is likewise found native in many parts of the world." It will be seen, therefore, that to arrive at the formation of bitumen and asphalt we must first consider the origin of naphtha. The word naphtha is derived from the Persian "nafta," to ooze out, but in this country the word is usually confined to a distillation from coal tar or wood tar; it is sometimes used, however, for one of the fractions of petroleum. Petroleum (from Latin petra, rock, and oleum, oil) occurs in enormous quantities in some very ancient rocks (Silurian and Carboniferous), and also in much later deposits (early Tertiary), and it is evident from its chemical composition that it is of organic origin. Accumulations of vegetable and animal organic matter which under certain conditions would have resulted in peat and finally coal have, as the result of peculiar circumstances, passed through various stages of decomposition by the influence of what has become known as "marsh gas" bacteria and been converted into a liquid.

Principal Deposits of Bitumen.—The island of Trinidad, British West Indies, is noted for the most remarkable deposit. Here in the south-west portion of the island is the famous "Pitch Lake," so named by Sir Walter Raleigh, who discovered it in 1595. He noted that the lake contained "abundance of stone pitch, that all the shippes of the world might therewith be laden from thence, and we made trial of it in trimming our shippes, to be most excellent good and melteth not with the sun as the pitch of Norway." The lake has many peculiarities. It covers about 100 acres, is roughly circular in shape, probably occupying the crater of an extinct volcano, and is of unknown depth. In 1893 an attempt was made to determine its depth at the centre by boring, but after sinking to a depth of 135 ft. the tubes had inclined to such an angle that the attempt had to be abandoned.

The lake has been worked under a concession granted by the British Government for some twenty-seven years, during which period some millious of tons of the material have been exported, the bulk of it going to the United States, but large quantities being shipped to England by Messrs. Previte and Company, of London. The crude material is dug from the surface of the lake, and although several tons may be removed in a single day, within thirty-six hours the excavations are said to refill by the natural pressure from below. The material is taken in iron skips to an aerial railway, which conveys it to the sea, some 800 yards distant, for shipping. Asphalt is also found beyond the boundary of the lake, especially between the lake and the sea. This is termed land asphalt. It is questionable how it got there, but the supposition is that the lake at some early date overflowed its banks. Although the physical properties of the asphalt vary considerably, even in the lake itself, as may be seen by the specimens exhibited, the chemical composition is extremely uniform.

Before the crude asphalt can pass to any of the many uses for which it may be intended it must undergo a process of refining, as it contains some 30 per cent. of water besides organic matter, which it is necessary to eliminate. This is usually done in tanks about 15 ft. deep filled with coils of 1¼ in. pipes about 6 in. apart. The coils carry steam at 100 lb. pressure, corresponding to a temperature of about 325 deg. Fah. At this temperature the asphalt, which is liquid, is run into casks, and is known as epure. In this condition it is ready to be converted by the addition of a flux into what is called for trade purposes "refined Trinidad Lake bitumen."

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* Abstract of a paper read in London before the Institute of Sanitary Engineers.

Another extensive deposit of lake asphalt is that at Venezuela, Bermudez. This covers an area of some 1000 acres, but is very shallow compared with the Trinidad lake. It varies in consistency in different parts of the lake from viscous maltha to solid bitumen. The crude material is richer in bitumen than that of Trinidad, but the composition of the refined bitumen is not identical in each. Deposits are also found is Cuba and other parts of the world.

Rock Asphalt.—Rock asphalt is entirely different both physically and chemically from lake asphalt; in fact, the only thing common to each is that they both contain bitumen. The following is a comparison:—

Diversities of Lake and Rock Asphalts

	Trinidad Lake. (Dry.)	Rock. (Seyssel.)
Specific gravity	1.4	2.25
Hardness	Plastic	Tough
Inflammability	Inflammable	Fire-resisting
Fracture	Conchoidal	Rough
Melting point	170 deg. Fah.	(Disintegrates)
Bitumen content	54	8
Calcium carbonate	—	91
Sulphus	3	—
Mineral matter (Silica)	35	—
Organic matter	8	—

Rock asphalt is correctly described as a limestone naturally impregnated with from 6 to 14 per cent. of bitumen, which gives it a rich brown colour. When the bitumen is extracted by means of a solvent the limestone is left in a state of very fine subdivision, and we might consider briefly how the stone became impregnated. Few rocks vary more in texture and composition than limestone; it may be a friable chalk-like deposit, a finely-grained rock resembling sandstone, or a hard, close-grained mass having a conchoidal fracture. In rock asphalt we have an example of a finely-grained deposit, the particles being cemented together, as it were, with what would first appear a foreign matter. The deposits are found in various thicknesses, 6 ft. and less to over 20 ft., and are at times laminated. The existence of laminae indicates tranquil conditions of intermittent deposit, and such thin layers occur only where the mineral is fine-grained, as in mud or shale. The alteration of thin bands of laminated rock with others non-laminated indicates considerable oscillation of currents from various quarters bearing different quantities and qualities of sediment.

The conditions favourable to the formation, or rather to the impregnation of limestone with bitumen, are the diffusion of organic material, either vegetable or animal, through the finely divided calcareous deposit and the exclusion of air from the material undergoing decomposition. There is reason to believe that no more heat was required than that afforded by the process of fermentation to bring about the changes by the aid of anaerobic bacteria. It is probable that the organic matter was in the form of delicate water plants, together with abundant infusorial or microscopic vegetable life. That the unimpregnated laminae should exist between the impregnated rock is conclusive proof that the bitumen-forming agents must have been entombed in the lime deposit, and that the impregnation was not brought about by external examinations, as is sometimes suggested.

Principal Deposits of Rock Asphalt.—Rock asphalt appears to have been discovered in the Val de Travers, Switzerland, by a workman named Jost, who brought it to the notice of a Greek physician named Eyrinis in 1712, and he was granted a concession by the King of Prussia to work the rock. However, the credit is, I believe, due to Count Sassenay for starting the asphalt industry on business lines and correcting mistakes made by Eyrinis, mentioned hereafter. In 1802 Count Sassenay secured the concession of the Seyssel Mine, and carefully investigated the properties of the rock and trained his workmen in the proper methods of using it. The principal deposits on the Continent which are used in this country are found at Val de Travers (Switzerland), Limmer and Vorwohle (Germany), Pyrimont, Seyssel (France), Ragusa (Sicily). The rock is quarried or mined according to whether the seam is near or far below the surface of the ground. As previously stated, the seams vary in thickness; they also vary considerably in texture and composition, even from the same quarry.

Mastic Asphalt.—Mastic asphalt is a mechanical mixture made by intimately compounding powdered rock asphalt with additional bitumen and with or without an admixture of coarse grit. The process of manufacture of mastic asphalt, as carried out by one or more well-known firms, and may for our purpose be accepted as the method generally adopted, is to first crush the natural rock to pieces about the size of walnuts. After passing through the crusher the asphalt is carried up by elevators to a disintegrator, which runs at a high speed, grinding the material to a fine powder. The powder is then cooked in specially-made cauldrons, worked by agitators, with certain proportions of bitumen, and when heated to a temperature of about 400 deg. Fah., a proportion of from 10 to 20 per cent. of fine grit is added to make gritted mastic, and which is thoroughly incorporated with the asphalt by the rotary working of the agitators. It is then turned out into iron moulds and made into blocks of various shapes weighing about ½ cwt. each. To apply the mastic, these cakes are broken into small pieces and carefully placed in a cauldron with just sufficient bitumen as a flux. It is then heated to a temperature of about 280 deg. Fah., the whole being carefully stirred until properly cooked. When ready it is taken from the cauldron with an iron bucket and spread by means of hand floats to the required thickness and rubbed with fine sand. As the mastic is likely to have blowholes, it is important that it should be applied in two coats where required for damp-proofing.

Tests for Asphalt.—The following tests are such as may be applied by an engineer or architect, but it is pointed out that special apparatus, as also an intimate knowledge of analytical chemistry, is necessary to determine the exact composition of the materials we are now considering. Much useful information on this subject is contained in "Natural Rock Asphalts and Bitumens," by Arthur Danby, who has kindly permitted the author to cull some of the following tests:—A simple method to adopt in order to tell one artificial bitumen from another consists in holding the product over an open flame and smelling the vapours which are given off. The residue from coal tar, wood tar, turf tar, or stearin, each of which has its own distinctive odour, is easily noticeable when the material is heated. A definite test for the presence of coal tar pitch in a suspected material is based on the fact that it contains a quantity of free carbon in contrast with the natural bitumen, which contains none. Natural bitumen presents a uniform brownish appearance when a little is fused on a microscope slide and examined under a microscope. In an adulterated sample the free carbon may be seen suspended in the bituminous matter like small black dots, though to the naked eye the mass appears to be true bitumen. Mastic should be able to be cut with a knife. If too hard or stony a nature it proves an insufficiency of bitumen. When held in a gas flame it should soften, it should never run or begin to ignite. If it burns, the mastic contains too much flux, and for practical purposes the material will prove too soft.

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*Abstract of a paper read in London before the Institute of Sanitary Engineers.

Application of Rock Asphalt.—As a material for paving streets asphalt has much to recommend it from a sanitary point of view. It is non-absorbent, easily cleansed, and suffers no material change from variations of temperature. Its suitability for this purpose was discovered by accident in 1849. Fragments of asphalt dropping from the carts which transported it from the quarry along the road became heated by the sun and were crushed to powder and compacted by the continual passage of the carts until a hard, smooth track was formed. The phenomenon thus presented, followed by many experiments, led to the perfect method of constructing the rock asphalt road now in use. In 1854 the first street of compressed asphalt was laid in Paris, and covered an area of 950 square yards. The first street to be so treated in London was Theadneedle-street in 1869. Rock asphalt may be utilised for road paving either as macadam, compressed powder, or as compressed tiles. As a macadam it would appear not to have been quite satisfactory, judging from the report on the Eltham-Sidcup trial road, but the author constructed an asphalt macadam road several years ago which gave satisfaction. For compressed work, the rock is prepared by heating the powder in revolving cylinders to a temperature of 280 deg. Fah., and as soon as the moisture has evaporated the heated powder is placed in iron-lined vans and taken to the street where it is to be laid. The powder is then raked over the prepared concrete surface to the thickness required and rammed with hot pelons, smoothed to a polished surface, and then rolled with a heavy hand roller. It gradually becomes cold, and in time is compressed into solid rock again by the traffic. The usual thickness of compressed asphalt is 2 in. for heavy and 1½ in. for light traffic. It is essential that compressed asphalt should be laid on a foundation of good Portland cement concrete about 6 in. thick. Neglect in this respect has been the cause of many failures.

Application of Mastic Asphalt.—Mastic asphalt is a most useful and efficient material, and is eminently suited to meet certain sanitary requirements. It is damp-proof, fire-resisting, vermin-proof, durable, has certain antiseptic properties, and is easily applied by a skilled hand to roofs, floors, walls, and for a variety of purposes in engineering and building works.

Damp-proof Courses.—To resist damp no better material exists than asphalt or bitumen properly applied. Clause 20 of the Model By-laws issued by the Local Government Board requires that every wall or pier of a new building shall have a proper damp-proof course of sheet lead, asphalt or slates laid in cement or other not less durable material impervious to moisture beneath the level of the lowest floor timbers and at a height of not less than 6 ins. above the adjoining ground. The by-law is quite clear, but the loose method of applying the terms "asphalted" and "bituminous" to felts treated with coal tar products tends to bring the genuine article into disrepute; so much so that a circular was recently issued to builders by the District Surveyors in London stating that "the material commonly known as 'felt damp-course,' asphalted felt or similar material, will not be approved unless a distinct and sufficient layer of natural asphalt or bitumen is provided in connection therewith." This cheap substitute for the genuine article cannot be too strongly condemned. No asphalt or bitumen is used in its manufacture and the fibrous material employed is subject to rapid decay in damp situations. The author knows of extensive property in London which is in a very unsatisfactory condition owing to this worthless material having been used, and frequently replaced it in existing buildings with a genuine damp-proof course at great expense to the owners. This, however, is the only remedy. With respect to the fire-resisting properties of mastic asphalt, much will depend on the quantity of bitumen it contains, the latter material being highly inflammable. It is not only the spread of the fire and the stability of the building that must be considered in case of fire occurring, although these are important factors; but the danger to the firemen employed in its extinction by falling debris. The London Building Act, 1894, Sec. 61, states that the flat, gutter, and roof of every building, &c., shall be externally covered with slates, tiles, metal or other incombustible materials. It would appear from a recent circular that the London County Council does not consider asphalt an incombustible material. It should be pointed out, however, that it if far more so than some of the metals, e.g., lead and zinc, which are permitted by the Building Act.

Application of Bitumen Sheeting.—For several years past bitumen sheeting has been used for waterproofing purposes, more particularly for horizontal damp-proof courses, lining of reservoirs, sewage tanks, filter beds, swimming baths, &c., with great success. The sheeting is manufactured by coating jute cloth on either side with a heavy layer of bitumen. It is made in standard-size sheets, each measuring 24 ft. by 6 ft., and is about 3/16 in. thick. It has the advantage of being more easily laid than mastic asphalt. It is not suited for vertical work unless supported on the outer face. The most satisfactory method of fixing in a vertical position, as in the case of reservoirs, &c., is by the use of special wall ties, which are built into both the inner and outer walls. To fix the material in a horizontal position the sheets should be carefully unrolled and laid over the surface to be covered, due allowance being made for a 3-in. lap at the joints. The sheeting should then be left for a few hours in order that it may take a proper bearing before jointing. A special jointing iron is then heated and carefully passed between the laps to soften the bitumen on the inner surfaces, and these should promptly be united with a wooden mallet.

Causes of Failure in Asphalt Work.—The causes of failure are usually due to either the material used or the method of using it. These may be guarded against to a great extent by entrusting the work to a reputable firm. There are few materials which lend themselves to adulteration more than asphalt, and few which require more careful manipulation. Large quantities of low-priced mastic have been imported to this country from Germany and still larger quantities are "faked" here during their preparation and use. The author contends that the work to be done, however small the job may be, should be executed by the firm's own workmen. The mastic blocks should bear the brand of the firm, and no other material should be allowed to be mixed with them except the bitumen flux.

Repair of Defects in Reinforced Concrete

A comprehensive review of methods which have been employed to repair cracked elements of reinforced-concrete structures was given some time ago by Prof. S. Muller before the Deutsche Beton Verein, and is reported by The Engineering News. His account was based on extensive experiences in carrying out such repair or reinforcement, chiefly of floor slabs and beams.

The defects in question include weakness of the slab due to inadequate thickness for proper service as compression element of the T-beam; separation of slab from beam; and diagonal or horizontal cracking of the beam web. Vertical cracking, which sometimes occurs, is due to shrinkage and is not considered dangerous.

Beams

In the earliest repair jobs on defective beams the plan adopted was to strengthen the floor by adding supplementary beams or by setting a column under the middle of the weak beam. In some cases a pair of I-beams has been placed alongside the weak concrete beam; but this is generally uneconomical, because the uncertainty of the load distribution makes it necessary to proportion the steel beams to take the entire load. Diagonal cracking, indicating a deficiency of shear reinforcement, has been repaired by placing vertical or inclined steel stirrups around the web of the beam and screwing them up tight. This method did not always prove satisfactory, however, especially in structures subject to vibration. The best method of repair yet developed is to place cramps over the crack, dowelled into the sound concrete on both sides, and incase them in a shell of concrete, for which space may be made by chipping off the original concrete for a depth of an inch or so.

Slabs

Where a slab requires to be reinforced, to provide additional compression area for T-beam action, a good bond of the new top layer has generally been obtained. Thorough cleaning of the surface is first necessary, followed by roughening the old concrete by picking or otherwise; after wetting the surface, a 2-in. layer of concrete well reinforced by a strong mesh is placed. The mesh should be tied to the reinforcement of the old concrete by steel-tie members.

Where slab and beam have separated the scheme has been employed of adding such a reinforced upper layer on top of the slab and tying this down through holes in the slab to cross-bars passed through holes in the stem of the beam.

It has been found that painstaking work is necessary for success in repairing reinforced-concrete structures. With care, however, the patches or new elements can be made structurally integral with the old parts. Satisfactory appearance can be secured. In the best work the patches are practically invisible.

Will Mixing Concrete Too Wet Cause Its Failure?

IN an interesting discussion of this subject published in a recent issue of Concrete-Cement Age, Mr. C. H. Fuller, an engineering-contractor of Corinth, Miss., contributes the following:

"In the earlier days the tendency was to mix all concrete too dry and sidewalk and concrete block people still adhere to that practice, with the result that their products do not attain the strength of the wetter mixtures. Now the tendency, owing largely to the chuting systems of deposition in forms, is causing the pendulum of opinion to swing in the other direction and many contractors are mixing too wet, something that one is easily tempted to do because it facilitates the handling of the material.

"Mixing concrete is a chemical process and if sufficient water is not added at the time it is mixed, the cement not only fails to become thoroughly mixed with the balance of the material but from lack of water at the initial moment fails to attain the adhesive strength it should. On the other hand the addition of too much water causes the cement to segregate and separate from the heavier material and this is especially true in chuting systems. The exact proportion of water causes it to adhere and cling to the heavier material until it is all deposited in an even mass in the forms and from its weight the excess of moisture is removed. To get perfect concrete, just enough water should be added to make a thoroughly creamy consistent mixture in which every unit of the heavier material is thoroughly coated with cement and in which the heaviest stones will float and set without settling to the bottom. This kind of a mixture is easy to tamp, does not flow quite so readily in the chutes, requires more mixing and has a tendency to clog the mixer and tools but produces very little sweating or leaking of forms. While I have not had an opportunity to test samples of such concrete for comparison in the tensile and the crushing machines, I am convinced from observations in cutting holes in walls and mass masonry and in the destruction of concrete structures that the evenly mixed concrete is the strongest, and no concrete can be moved from the mixer and deposited in the forms and remain evenly mixed if there is too much water in it.

"On any large job, where the operations were sufficiently diversified, any one who knew just what he was looking for and equipped with a good camera would in a few days of watching pick up a number of photographs, the comparison of which would convince any rational minded man that the quantity of water plays an important part in the mixing of concrete. With a dozen or more photographs, such as I have in mind, I believe that I could put up a convincing argument along this line."

A suggestive paper contributed to the annual meeting of the American Concrete Institute by Mr. N. C. Johnson dealt with micro-photography as applied to the examination of concrete, with the object of obtaining better knowledge of the structure of the material itself. A fact particularly mentioned by the author was that all specimens of concrete examined by him possessed a surprisingly large quantity of unhydrated cement, a feature he attributes to the difficulty in diffusing the water completely during the process of mixing. The voids revealed by the microscope also emphasize the importance of scientific grading.

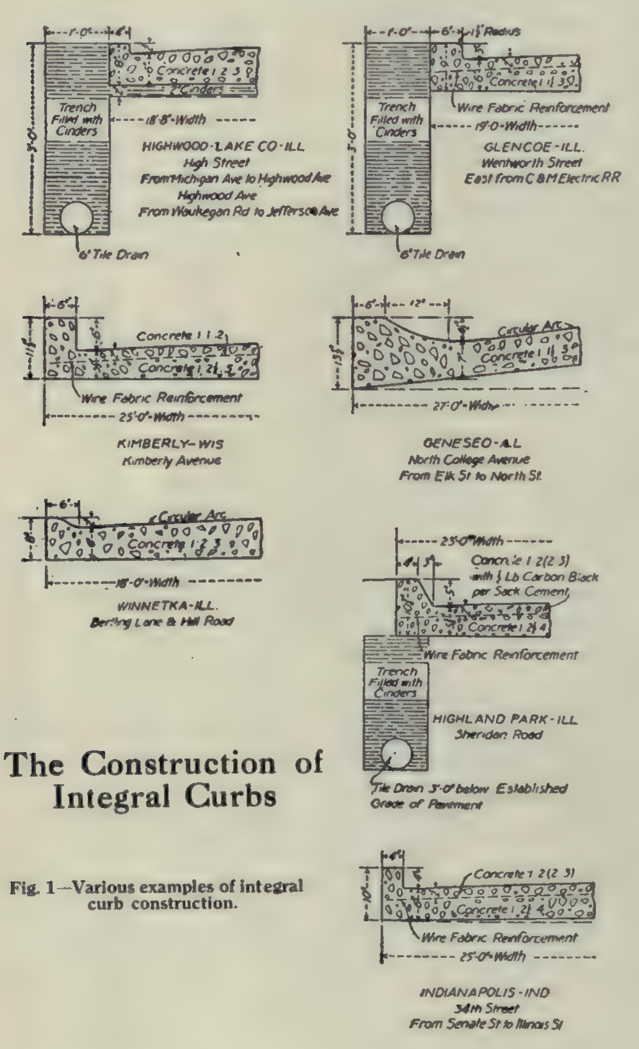
The Construction of Integral Curbs*

A Method of Pouring Curb and Pavement in one Monolithic Mass, whereby the Cost of the Improvement is Materially Reduced.

By Chas. E. Russell†

ALL street pavements call for some form of curb and gutter, the cost of which to property owners usually amounts to from 45 to 90 cents per linear foot of street frontage, an expenditure often equivalent to 25 per cent. of the cost of the pavement proper.

The cost of a proposed type of improvement often eliminates it from consideration, and forces property owners to substitute an inferior type. There have been numerous cases where concrete pavements have been rejected for inferior and cheaper pavements, when the property owners would gladly have accepted concrete if it could have been reduced from 10 to 15 per cent. in cost. This reduction in cost can be made by the adoption of the integral concrete curb—that is, one moulded as a part of the pavement.



The Construction of Integral Curbs

Fig. 1—Various examples of integral curb construction.

During the last year successful demonstration has been made that integral curb reduces the cost at least 60 per cent. for a 6 by 6-in. curb projection, while larger saving can be shown for smaller curbs and for gutter depressions. This being true, the integral curb deserves thought and investigation by engineers and others interested in paving work, even though they do not immediately recognize its merits.

During the last year several distinct types of curb and gutter were built successfully, each type designed to suit the scheme of landscape and local conditions. Fig. 1 shows the designs of curb on pavements at Highwood, Glencoe, Winnetka, Highland Park, and Geneseo, Ill.; Kimberly, Wis.; and Indianapolis, Ind.

The types of curb, or rather gutter, built at Geneseo and Winnetka, Ill., are well adapted to boulevards, park systems, suburban residence streets, and lanes. These may be formed by shaping tre ends of the strike-board to the desired curvature. Cost can be estimated on the basis of additional square yardage of pavement, which generally amounts to from 3 to 5 cents per lin. ft. of curb, when the cost of curb joint construction, including filler, is deducted.

The type of curb built on Sheridan Road at Highland Park, Ill., in 1914, is the kind that would be suited to the average street. More concrete is required, and a curb form must be used. Cost would be estimated at about 18 cents per lin. ft. of curb, which was about the actual cost of the Sheridan Road work.

Integral curb, being a part of the pavement and composed of the pavement concrete mixture (which is of a rich mixture) reinforced by turning the pavement reinforcement up into the curb form, naturally results in a curb stronger than the average; and such construction cannot tip over or be forced out of alignment. It serves its purpose as a curb without doubt, and as well as any other type.

An objection which has been advanced is that the integral curb is difficult to construct. Such objections are common to all new types of construction until contractors become familiar with methods, and therefore should in no way discredit the integral curb; in fact, the manner in which the problem was handled on the first jobs of this kind indicates that a satisfactory and economical method of construction can be evolved.

The essential requirements for the construction of integral curb are complete bond with the pavement, perfect alignment, good surface finish, clean joint coinciding with the pavement transverse expansion joint, and simple, inexpensive forms. When forms are devised that will meet with the above requirements there can be no objection to the integral curb.

Should each contractor, without previous knowledge or experience, endeavour to construct integral curb with forms of his own devising, it would probably be some time before perfectly satisfactory integral curb would be built to any extent. In the meantime this desirable economic construction would be discounted or discarded.. If, on the other hand, we place before those who are inexperienced a form which at least has some merit, and which is designed on the fundamental principles stated herein, they should be better able to construct a more satisfactory job and at a more reasonable price; furthermore, each

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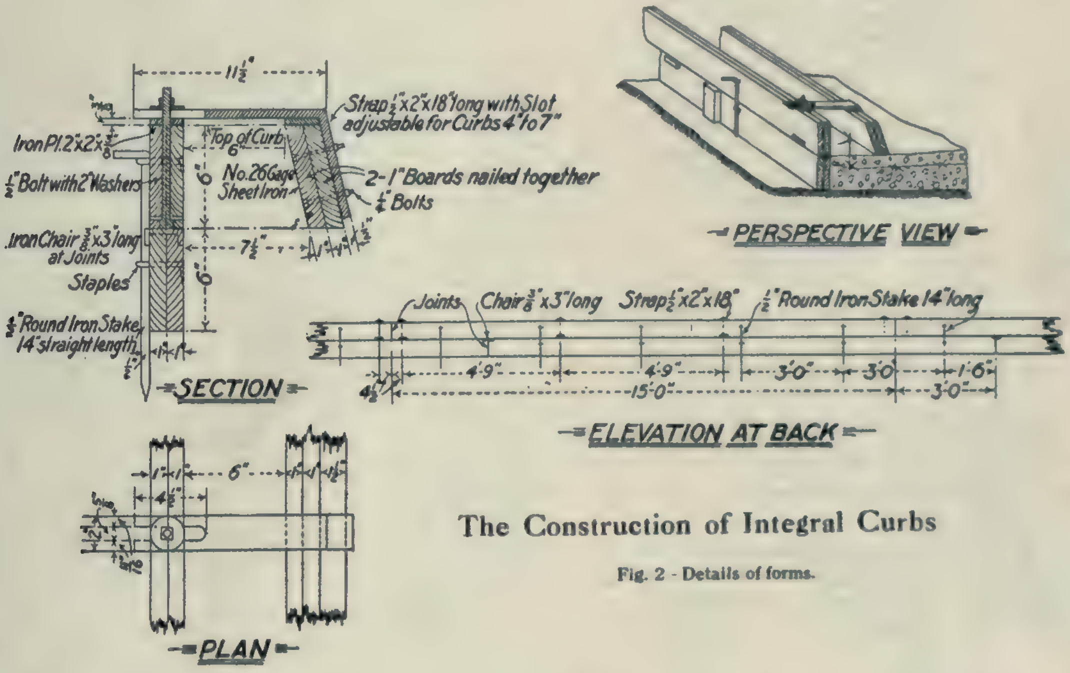
*Paper presented to the American Concrete Institute.
†City Engineer, Highland Park, Ill.

time a form is used, some improvement will be made in it; and it will be but a short time before the best forms are evolved, and then the integral curb will become a standard with concrete pavement.

A design for integral curb forms is shown in Fig. 2. This is presented as a suggestion, and it is hoped it may be of help to those in this field of construction, and that each one who is interested in integral curb will study the design and improve upon it.

Taking up the essential requirements of integral curb construction as previously given, we shall not analyze them in connection with the suggested forms. For economic construction, the curb must be made of the concrete of which the pavement is composed. Such concrete will be of quaky consistency, and probably of the proportions 1:2:3, with the coarse aggregate up to 1½ ins. in size. Pavement side forms are staked into position, concrete dumped between them and then struck off, just as in any concrete road work. Within fifteen minutes after the pavement is struck off the curb forms are set and filled. Complete bond is obtained by roughening the concrete at the bottom of the curb form by running a mason's trowel or a stick along through it just before the concrete fill is made. Pavement reinforcement turned up into the curb also assists in strengthening the bond. The form for the back of curb is set upon the top of the pavement form, and held snugly to it by pins run through staples in both forms, and driven into the ground. The front form is held to the back one by adjustable iron strap clamps which permit perfect alignment of the front form after being set up in place. Warping of forms is also minimized by using 1 by 6-in. lumber nailed tightly together, with nails clinched.



The Construction of Integral Curbs

Fig. 2 - Details of forms.

When the concrete fill is made, it should be worked to get a compact mass. This is best done by spading it with a shovel, after which a mason's trowel or a blade similar to a corn-harvesting knife should be run along against the front form, to cut the coarse aggregate away from the form and thus work the mortar to the face. The front form is lined with sheet iron so that a smooth face is obtained without further trowelling. The top can be edged and finished readily while the forms are in place. No work will be done on the curb after the forms are removed, except touching up defective spots.

Expansion joints are required in the curb at and coinciding with transverse expansion joints in the pavement. These must be exactly over the joints in the pavements, for if they are not the curb at these places will be likely to spall off.

Since a concrete of quaky consistency is to be used, forms must be left in place at least three hours. This will necessitate having on hand about two or three hundred linear feet of forms. These, however, are of simple construction, and inexpensive. Fifty dollars will cover the cost of forms with which to lay at least 600 lin. ft. of curb a day.

Admitting that most of us are likely to find objections to this new type of curb, we cannot conscientiously cast the idea of integral curbs from our minds, because its adoption will create a saving of approximately 60 per cent. of the cost compared with independent curb.

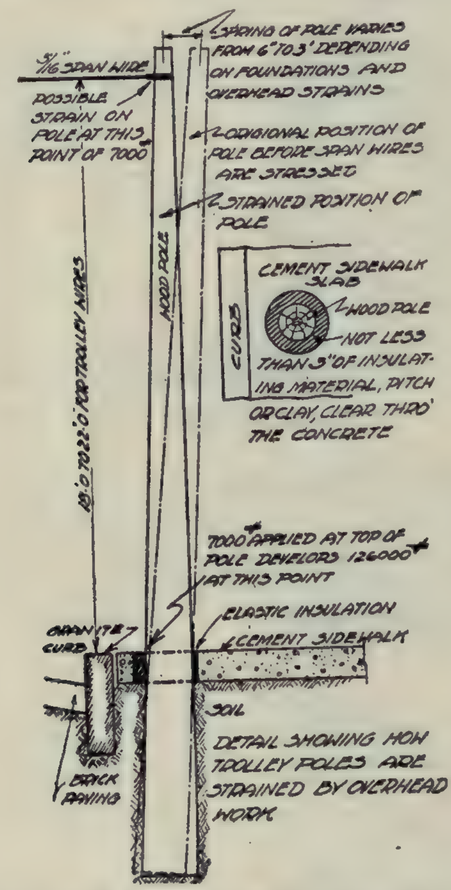
In answer to a question as to whether the curb is poured at the same time as the rest of the pavement, and whether there is any trouble in striking off the road when building the curb, Mr. Russell replied:

"The road is first struck off before putting on the inside form. After the road is crowned, and before it is floated, the inside form is placed, and then filled with the same mixture of concrete as is used in the top course of the pavement. That is smoothed off, and after it has set sufficiently it is trowelled."

The amount of polish which can be given to the surface of concrete depends upon the density of the mixture and the nature of the aggregate used. After the surface has been smoothed down on a rubbing bed, or by the use of rotary rubbing stones, as applied in terrazzo floor work, the procedure is somewhat similar to that used in polishing granite or marble. The aggregate exposed on the surface by the rubbing process takes the polish, the appearance of the surface being dependent upon the percentage of aggregate exposed.

Splitting of Concrete Sidewalks Surrounding Iron Posts*

It is not an uncommon sight to see long stretches of concrete sidewalk disfigured by being badly split, checked and broken or curbing pushed out of line where the slab surrounds and comes in contact with trolley poles, public service poles, fire hydrants and such obstructions, which extend through the sidewalk to various depths in the soil below. A little careful consideration of the subject will show these defects to be largely the result of carelessness and incompetence on the part of the mechanic who does the work and to ignorance or indifference on the part of those supervising the work; nor should the contractor be blamed for not taking the necessary precautions under the present methods of competition, when the city or the owner is willing to risk such possible disfigurement in order to effect a very small saving in first cost.


SPRING OF POLE VARIES FROM 6" TO 3' DEPENDING ON FOUNDATIONS AND OVERHEAD STRAINS
5/16" SPAN WIRE
POSSIBLE STRAIN ON POLE AT THIS POINT OF 7000
ORIGIONAL POSITION OF POLE BEFORE SPAN WIRES ARE STRESSED
STRAINED POSITION OF POLE
WOOD POLE
18'0" TO 22'0" FOR TROLLEY WIRES
CEMENT SIDEWALK SLAB
CURB
WOOD POLE
NOT LESS THAN 3" OF INSULATING MATERIAL, PITCH OR CLAY, CLEAR THRO' THE CONCRETE
7000# APPLIED AT TOP OF POLE DEVELOPS 126000# AT THIS POINT
ELASTIC INSULATION
GRANITE CURB
CEMENT SIDEWALK
SOIL
BRICK PAVING
DETAIL SHOWING HOW TROLLEY POLES ARE STRAINED BY OVERHEAD WORK

Sketch showing concrete sidewalk surrounding trolley pole.

The writer has long been an advocate of three feet or more of street lawn between the curbing and the edge of the sidewalk, which not only provides sufficient space for these inevitable obstructions, where they will do the minimum of damage, but affords an opportunity to beautify the street by planting trees. However, there are many places in every town, where the sidewalks, of necessity, extend from the crub to the building, and in such locations the application of a little common sense and some slight additional expense, infinitesimal when compared with the results obtained, will eliminate nine-tenths of such unsightly defects, if applied when the sidewalk is laid or when holes are cut in old sidewalks for new poles.

The causes of the trouble differ, depending on the object set through the walk and the purpose for which it is put there, but the resulting effect, the destruction of the walk, is the same in any case and the remedy, described later, is simple.

Usually the street railway company's trolley poles are the most destructive of all of these obstructions and the reason is not far to seek, if we take our attention from the sidewalk itself, for a few moments, and consider their purposes and methods of erection. Usually these are of wood, generally untreated (which is immaterial, any way) and therefore subject to considerable shrinkage or expansion owing to atmospheric changes. One who has not given the subject much thought may object that a wood pole alternately dry or saturated by rain would not swell sufficiently to check and break the surrounding slab of concrete. As evidence to the contrary, one of the methods of quarrying fine building stone is to drill a row of holes along the desired line of cleavage, sometimes several feet in depth, plug them with kiln-dried wood plugs, then saturate these plugs with water. This process will split huge slabs of the hardest granite, so what chance has the poor, thin little slab of concrete, against the destructive force generated by a swelling pole?

There is another factor of still greater destructive tendency, regardless of whether the pole be of iron or of wood, and that is the enormous strains induced by what the street railway man calls his overhead work. The pole-setting gang sets the pole with a slight inclination away from the trolley, sometimes as much as three feet from the perpendicular at the top, as shown in the accompanying illustration. The trolley or line crew then connects these poles together in pairs, by a 3/16-in. or a 5/16-in. stranded wire cable some 18 ft. or 22 ft. from the ground, and by means of tackle strains these poles into a plumb position. On high-class work the pole man frequently fills the hole in which the pole is set with a low grade concrete, to give it greater stability, and a 5/16-in. span wire cable at the top is capable of producing a 7,000-lb. pull, which, if the pole is capable of withstanding such a strain, induces a permanent set or spring in the pole with a possible strain or reaction at the point at which it passes through the sidewalk up to 125,000 lbs. The line foreman counts on this resiliency of his poles to take up the slack in the overhead incurred by the expansion and the contraction of the connecting wires. Between the cool of midnight and the heat of noon time, the tops of a pair of trolley poles will vary one foot or more in relation to each other, and this movement to a lesser degree but greatly multiplied in stress effect is communicated to the surrounding slab of sidewalk which is absorbing a shock it was never intended to carry, and being of a comparatively unyielding composition, breaks away at the point of contact.

Telephone and telegraph poles, though stressed in a different manner and more uniformly along their centre line, affect the sidewalk in a lesser degree, but anyone who has seen a thoroughly sound new pole some 12 in. to 20 in. in diameter, sheared off clean at the sidewalk line, from the stressing of numerous overhead wires, will readily appreciate the enormity of these strains which must produce a resultant in the sidewalk or the foundations below it.

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* By C. B. Fuller, consulting engineer, Indianoplis, in Concrete-Cement Age.

Sometimes these strains are of a torsional or twisting nature, and the writer has seen one case in which the twisting power of the overhead wiring applied at the top of a 60-ft. pole of 20-in. butt, was sufficient to separate the fibres of the wood at a point within easy reach sufficiently to permit the passing of an ordinary hand axe through the hole without severing a single fibre of the wood. Where such strains are produced, is it any wonder that the sidewalk suffers?

With fire hydrants, the strains are largely temperature strains, but, being connected to the city mains by unyielding cast iron pipe and bedded in the cool earth the rate of expansion differs from and is not coincident with the temperature variations in the thin, flat and exposed sidewalk slab, so that movement does not necessarily take place in the same direction, and so produces destructive results.

There are numerous other poles of different types and purposes, set through the sidewalk, not always connected but all more or less firmly bedded in the underlying soil. The sidewalk slab is bound to move as it expands under the rays of the sun, and as all of these obstructions are opposed to the normal movement of the slab they are destructive in their influence.

As a remedy, when building new sidewalks around such obstructions, the writer usually specifies that a space of approximately three inches be left clear of concrete around them, giving them an opportunity to perform the functions imposed by saturation, overhead strains or expansion, without injury to the walk. This may be readily effected by wrapping several thicknesses of expansion filler around each pole before concreting; or a circle of tin, leaving the desired clearance, may be bent around the pole to make a form against which to finish the concrete. If the latter is used, care should be taken to fill the space between the tin and the pole with clay, sand or pitch to prevent a careless workman from defeating the object of such precautions by disposing of surplus cement in the interstice. When it is desired to prevent the water from centering between the slab and the pole, a soft pitch makes a good insulating material, as it readily accommodates itself to any movement of the pole or the sidewalk.

Where a hole is cut in an old sidewalk for a new pole the same precautions should be taken in patching the paving as outlined for new work.

Where poles have already been set and the sidewalk laid flush with pole, any further development of cracks and checks may be prevented by chipping out a ring of concrete around the pole and filling the interstice with pitch.

It is doubtful that the corrosion of metal embedded in the concrete has any serious influence in making such checks and cracks in the sidewalk. It is a fact that iron or steel when properly protected seldom rusts appreciably, and concrete rich in cement forms a high-grade rust insulation, as evidenced by the bright tool marks found on steel removed from concrete in which it has been embedded for long periods. If the iron poles are insulated from the concrete, as described, the effect of corrosion, other than a slight stain, need not be feared.

The writer does not advocate such insulation as a cure-all for defects in sidewalk work, but experience and observation have demonstrated that the results fully justify such precautions. It is to be regretted that owners and city supervisory forces do not appreciate more fully the necessity of caring for expansion in a less perfunctory way than is customary. Nearly every city engineer has the authority to insist on some such precautions against those unsightly defects, and if he does not incorporate some such features in his specifications, neither the contractor nor the owner at the present stage of the game can be expected to assume the burden of such precautions, slight though the cost may be.

Oil-Proof Reservoirs of Concrete

By Wm. M. Kinney[*]

So far as the effect of oils on concrete is concerned, the general conclusion, based on the results of tests and actual experience, seems to indicate that mineral oils (under which head may be classed lubricating oils and gasoline) show only a slight tendency to soak into the concrete and perhaps reduce its strength somewhat. The extent of this action, however, depends largely upon the quality of the concrete.

Several engineers have made investigations of concrete structures subject to the effect of engine oil and the like, and have found that in the few cases where there was any evidence of disintegration the concrete itself was of poor quality or the workmanship was inferior. If the concrete exposed to the mineral oils is porous, injured by frost while hardening, of a lean mixture, poorly mixed or improperly cured, there is no doubt that general penetration and weakening of the concrete will result. If, however, the concrete is made of well graded materials, properly proportioned, mixed and placed so as to obtain a dense, compact mass, the oils will have no destructive effect on the concrete.

A concrete tank built in San Antonio, Texas, is reported in Engineering Record of May 30, 1908, as having at that time been in service for three years, holding heavy Texas oil, without showing any leakage whatever.

In Engineering News of July 4, 1907, is reported a concrete tank for fuel oil which was built for the Tonopah Mining Company at Millers, Nev. The tank is built with the top flush with the ground line or a few inches above it in order to prevent any drainage running into it. The inside dimensions are 84 ft. 6 ins. long, 35 ft. wide and 8 ft. deep, the capacity being approximately 145,000 gals., or 4,700 bbls. The walls of the tank are 4 ins. thick and the sides and ends of the tank slope in an angle of 60 degs. with the base. A rim around the upper periphery is 12 ins. x 12 ins. In mixing the concrete, great care was taken to prevent broken stone larger than ¾-in. from entering the mixture, in order that seepage of oil might be prevented. The mixture used was 1 part cement, 1 part sand and 1 part broken stone. Reinforcing bars were used at the inner sections of angle corners only.

In Engineering News, Vol. 57, No. 1, p. 12, is described an experiment made on the use of concrete tanks for storing fuel oil. One tank was made and filled with oil and at the end of nine months the tank was absolutely tight, the oil having penetrated and discolored the concrete less than one-half inch, and the concrete remained apparently sound and uninjured.

Several tanks for storing Texas oils have been constructed by the different railroads at El Paso, Tex. A letter from the El Paso & Southwestern System states that it has used concrete tanks to store crude oil uninterruptedly for five years and finds that the concrete has not been injured in any way.

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[*] Engineer in charge, Information Bureau, Universal Portland Cement Company, Chicago. Writing in Concrete Cement Age.

The San Antonio Gas & Electric Company, San Antonio, Tex., has constructed a tank for storing heavy oils, and its superintendent states that after three years' use the tank shows no sign of leakage or deterioration.

Concrete Oil Tanks at Toronto

Four reinforced concrete tanks for the storage of oil were built in the fall of 1910, for the Queen City Oil Company, Toronto, at its West Toronto yards. These were for the storage of the lighter products of petroleum. The inside dimensions for each tank were 21 ft. 6 ins. wide, 38 ft. long and 9 ft. 6 ins. high. They were placed underground and a cover of three feet of earth placed on top of them. The only precautions taken were to obtain a dense concrete and avoid joints and seams. Immediately after stripping the forms, cement grout was applied on the green concrete.

We would suggest a 1:2:4 concrete, made up of 1 bag of cement, 2 cu. ft. of clean, coarse sand, and 4 cu. ft. of well graded, durable crushed stone or gravel varying in size from ¼ in. to 1½ in. The concrete should be mixed with sufficient water to give a wet, quaky consistency. It is not necessary to mix any oil-proof or waterproofing compounds with the concrete, if care is taken to obtain a dense, impervious surface by proper proportioning, mixing and spading of the concrete near the face of the wall. As an extra precaution, the inside of the tank may be brushed with a mixture of cement and water of about the same consistency of cream.

It is very important that the concrete be uninterfered with in its hardening process for a much longer time than is necessary when the concrete is to be subjected merely to water or weather conditions. We recommend that a tank which is to contain oil be allowed to harden from two months to three months before filling with oil, during which time plenty of water should be used to assist the hardening process. The Standard Oil Company is using many concrete tanks for the storage of its oil products, and there is no reason at all why concrete should not be used in the construction of oil tanks, if precaution be taken to allow the concrete to have an unusually long time in which to obtain its full strength before the oil is put into the receptacle.

Oil will not penetrate through a tank of concrete if it is properly constructed and the concrete has been rightly proportioned. Concrete oil tanks are in use extensively throughout Texas and the Southwest. The C. M. & St. P. Ry., the A. T. & S. F. Ry. and the Standard Oil Company all use concrete oil tanks for storage purposes. Reports from the various division engineers of the Santa Fe R. R. Company, regarding the concrete oil tanks on their divisions, show that concrete was entirely satisfactory. The greatest depth to which oil penetrated was 1½ ins.

Pavement Widths and Crowns[*]

By H. I. Fixmer[†]

As a general policy, the length of road improved is more important than the width. This rule does not often apply to city streets. The determination of proper width of roadway is an extremely important element in design.

A traffic census is often desirable, but unless it is truly comprehensive more can be learned by direct and frequent observation of the street in hand. A traffic census must give not only number and size of vehicles, but the different kinds, kinds and sizes of tyres, wheel loads, rates of speed, space required for storage and parking, and character of adjoining property.

It is customary to allow 8 ft. in width to each line of vehicles, reducing this width as shown in Table I. Where two car tracks are built, not over 10½ ft., centre to centre, a width of 20 ft. is allowed for the free movement of the cars. Table II. shows widths and lengths of typical vehicles found on the streets of Chicago.

Unless the traffic exceeds or promises to exceed from five to ten vehicles a mile moving in either direction, 9 ft. in width should prove ample on our country roads. It is better policy to build a so-called "permanent" road 9 ft. wide (with a 5-ft. earth shoulder on each side) than a poor road 18 ft. wide. In view of the fact that perhaps over ninety per cent. of the time the vehicle occupies the middle of the road, and even in practice on the wider road usually prefers to suffer the slight inconvenience of turning out occasionally in order to ride on the more comfortable or acceptable part of the road, it appears logical to give due weight to this factor of "practical use." If a 9-ft. permanent road is built additions can always be made whenever the traffic warrants it. When consideration is given to the habits and needs of the users of the roads, the soundness of the policy that length of permanent road is more important and desirable than width is soon appreciated.

In city pavements the use of the street for "storage," or rather provision for vehicles to stand alongside or backed up to the curb in front of abutting property, must be considered, and is a vital factor in ascertaining the rational width of roadway.

Thus, in the case of a street having many warehouses, where large trucks back up to the curb to handle goods, we would, after finding that this condition prevails on both sides of the street and that allowance must be made for two lines of moving traffic between the "standing" trucks, determine the roadway to be not less than twice times 8 ft. plus length of truck backed in position. From Table II. this would give 2 (8 + 14) or 44 ft.

In residence districts, where connecting streets are paved as a system, the roadways on all streets where the lots front are made from 24 to 30 feet wide, and side frontage streets from 18 to 24 ft. wide.

Perhaps the most serious condition in securing adequate roadways exists on streets having a double-track car line. Such streets are invariably "business" streets, and require "storage" space for vehicles and automobiles. On such a street, providing for two lines each

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[*] From a paper entitled "The Design of Pavements," presented at the thirteenth annual meeting of the Illinois Society of Engineers and Surveyors, Springfield, Ill.

[†] Division Engineer in Charge of Paving, Board of Local Improvements, Chicago, Ill.

TABLE I.

Width of Roadway, ft.	Type of Street Usually Applied to	No. Lines of Vehicles Providing for
9	Average or Light Traffic Road	1
16–78	Side Residence Streets or Double Roadway Streets	2
24	Residence Streets	3
30	Residence and Business Streets	4
38–42	Business and Car Line Streets	5 (Exc 4 on car line)
48–52	Business and Car Line Streets	7 (Exc 6 on car line)
60	Business and Car Line Streets and Boulevards	8 (Exc. 6 on car line)

Table II.

Kind of Vehicle	Hub, ft. Width, Hub to	Length, Backed to curb, Front Wheels at Right Angles, ft.
Delivery Wagon	5.5 —6.7	8.7
Single Truck	5.8 —6.0	11.4
Large Truck	6.4 —6.6	12.8—14.0
Newspaper Truck	7.75	14.74
Touring Car	5.5 —5.8	10.0—16.0
Auto Truck	6.7 —*	12.0—?

* Widest truck measured 9.5 feet.

of street railway cars, moving vehicles and "standing" vehicles, we find a width of 2 (8 + 7 + 10) or 50 ft. is required. If the moving traffic is expected to use the car tracks, and the service on the street railway is infrequent, the width may be reduced to 2 (8 + 10) or 36 ft. A roadway width between 38 and 48 ft. in this case would be wasteful.

On a certain main artery in Chicago, where a double car line exists and the roadway is generally but 38 ft. wide, with stores continuously on each side, the unnecessary delay occasioned to the passengers on the street cars by teams and vehicles turning on and off the street railway right-of-way to pass standing vehicles amounts on the average to two minutes per mile travelled. This means that each passenger living an average of five miles from his work loses twice five times two, or twenty minutes, a day. Assuming a low value for his time of 30 cents an hour, the total extra loss to the car users equals the gross receipts of the street railway company! This sum capitalized indicates the sum that might be employed to reduce, or rather remove, the existing street congestion.

A street car that makes good time attracts more people and gives more time to shop, while it distributes business uniformly along the street. For this reason, when a street becomes too congested it becomes necessary to widen the street or place the car line on an elevated structure or in a subway. It is an extremely important question to decide whether it is better to build a subway in a congested business street or use

TABLE III

Kind of Pavement.	Chicago Average Constant "F"	Max. "F"	Min. "F"
Earth	.025		
Gravel	.022		
Macadam	.020	.035	.020
Asphalt	.012	.025	.011
Asphaltic Concrete	.015	.025	.012
Brick	.012	.025	.010
Creosoted Wood	.010	.022	.010
Granite	.015	.025	.010
Concrete	.010	.020	.010

Formula 1.

$C = WF$

where

C = crown, in inches.

W = width of roadway, in feet

F = a constant.

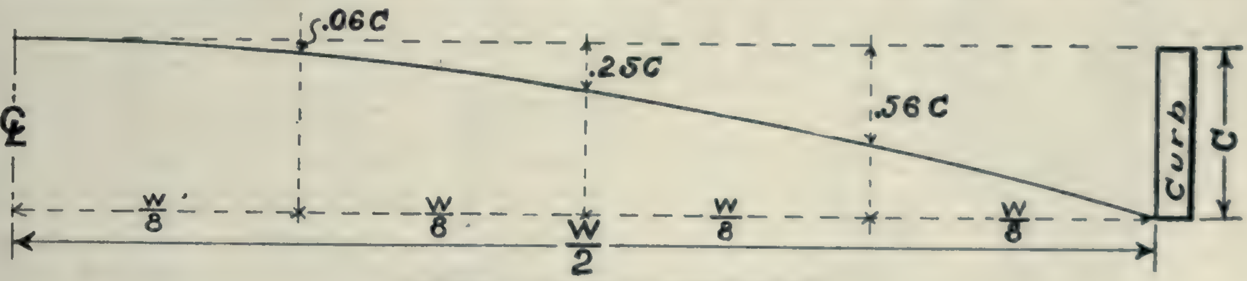

FIGURE 1—PARABOLIC CROSS SECTION.

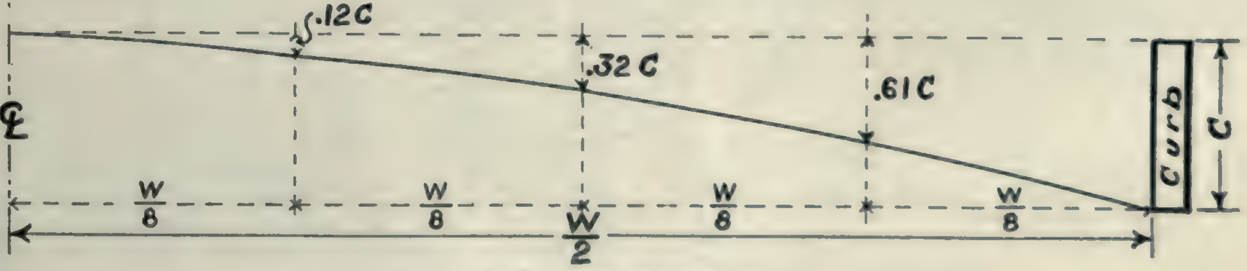

Fig. 2.—Compromise cross-section.

The new Knox College, Toronto—St. George Street elevation.

the money to widen the street and keep the car traffic on the street surface in the open air and easily accessible.

The contour of the pavement surface is a matter of more than ordinary importance. For the purpose of drainage the pavement is built with a convex surface; the difference of height of the surface at the centre line and gutter line being called the "crown." Table III. shows the constants employed to determine the crowns of various types of roads and the maximum and minimum values for the constant, as used in Chicago.

As usually built the surface is either an arc or a circle or a parabola. Experience has demonstrated that the parabola form (Fig. 1) is preferable for residence streets, and the "compromise" form (Fig. 2) is more satisfactory on business or "car line" streets, and particularly for pavements having a macadam base.

Country roads can usually be built with a constant crown, since they follow the contour of the natural surface and have sufficient longitudinal grade. If the grade is level the drainage can be taken care of by sloping the grade of the side ditches.

With city streets, which are invariably curbed, if the longitudinal grade is not sufficient to carry off the water, drainage must be provided by "artificial" means. This is done by building sufficient inlets and establishing "summits" in between, whose locations depend upon the grade of street, slope required to drain, and the permissible depths below the curb of the summits and the inlets.

The following formula is given for locating summits (in the gutter):

Formula 2: $$X = \frac{L}{2} - \frac{D}{2R}$$

where
X = Distance of summit from higher inlet;
L = Distance between inlets;
R = Grade of gutter (e. g. 6 ins. fall per 100 ft. = .005);
D = Difference of elevation at inlets (or, usually, the difference in elevation of curb at inlets); all in feet.

On a concrete gutter the assumed value of "R" should not be less than .004. For any block pavement, including alleys, the value for "R" should be not less than .005.

The following formula is given for determining depth of summit and depth of inlet below curb (or grade) to satisfy values in Formula No. 2.

Formula 3: $$J = K + RX + \frac{DX}{L} \text{ or } K = J - RX - \frac{DX}{L}$$

where
J = Depth of inlet below curb (from 8 ins. to 12 ins.);
K = Depth of summit below curb (usually 3 ins.).

The minimum crown from Table III. is used at the summits, and the maximum crown is permitted at the inlets. This reduces the grade along the centre line of the pavement to about one-half the gutter grade, and gives a comfortable surface to travel on.

In shooting to spring holes, tamping them by filling them with water is often preferable to using clay or other material, according to the "PuPont Magazine." Water, however, is not usually anything like as effective a tamping material as sand or clay. Where gravel, tailings or rock dust is used as a tamping material it may be first packed into little bags with economy to prevent cutting fuses and scraping the insulation off battery wires. Misfires often result from this cause. Contractors, however, are generally alive to the advantages of a suitable tamping material, and often buy sand for the purpose, where it cannot be obtained in any other way.

Water Meters in London, Ont., numbered 2562 Jan. 1, 1915, an increase of 486 during the previous year. Only 17 per cent. of services are metered, although 24 per cent. of the water consumed passes through meters and furnishes 40 per cent. of the revenue. Each inhabitant of this town of 56,000 population consumes on the average 81 Imperial gallons per day and the cost of supplying water is $34.15 per 1,000,000 gal.

An Automatic Device which Controls Hypochlorite Application

Apparatus at Institutional Plant Proportions Accurately the Amount of Chemical to Varying Flow of Sewage

AN ingenious device for the automatic measurement of the hypochlorite solution used as a disinfecting agent in the sewage treatment plant at the State Hospital for the Insane, Warren, Pa., has been constructed recently and is operating in a very satisfactory manner. The plant, which is described in The Engineering Record by Mr. E. E. Ludwick, was constructed during 1912-13, and treats all the sewage of the hospital group of buildings, having a resident population of approximately 1800. The works comprise a 6500-gal. Imhoff tank, intermittent siphon, sprinkling filter, chemical house, and a final settling tank.

Layout of Chemical House

The chemical house is provided with reinforced-concrete tanks, arranged as shown in Fig. 1. In the north-east corner, at a height of 3½ ft. above the floor, are two dilution tanks, A and B, with a capacity of approximately 660 gals. each, separated by a 4-in. division wall. A mixing trough, C, with a capacity of approximately 100 gals., is supported by this division wall (Fig. 2). A short distance in front of the dilution tanks, and at a height of 2 ft. above the floor, is a measuring box, D, with a capacity of 20 gals., and a little to the side of D, at a height of 6 in. above the floor, is a feed box, E, with a capacity of 22 gals.

The hypochlorite of lime is first dissolved in the mixing trough, C, and then allowed to enter the dilution tanks, A and B, through the outlets shown in Figs. 1 and 2. These outlets are merely holes through the bottom of the mixing trough, which are closed by wooden plugs while the lime is being dissolved. After being diluted to the proper strength the valves in the two 1¼-in. galvanized iron pipes which lead through the front of each tank are opened and the solution flows equally through each to a point where they combine into one 1¼-in. galvanized iron pipe terminating in the measuring box, D. Here a ball float valve (Fig. 3), is located, and, as the two valves mentioned above are left open, this valve controls the flow of the solution from the tanks according to the operation of the automatic device to which it is connected at this point. After flowing through the ball float valve into D, the solution is discharged into E, from which it enters the mixing channel and becomes thoroughly mixed with the effluent from the sprinkling-filter bed.

Automatic Measuring Device

The automatic measuring device, which is operated by the rise and fall of the sewage in the siphon chamber, and which proportions accurately the quantity of chloride solution with the varying flow of the sewage, is connected with the outlet and ball float control valve in D by the method illustrated in Fig. 3. The outlet in D is fitted with a brass ring seat, as shown at a, into and over which fits a brass cap con-

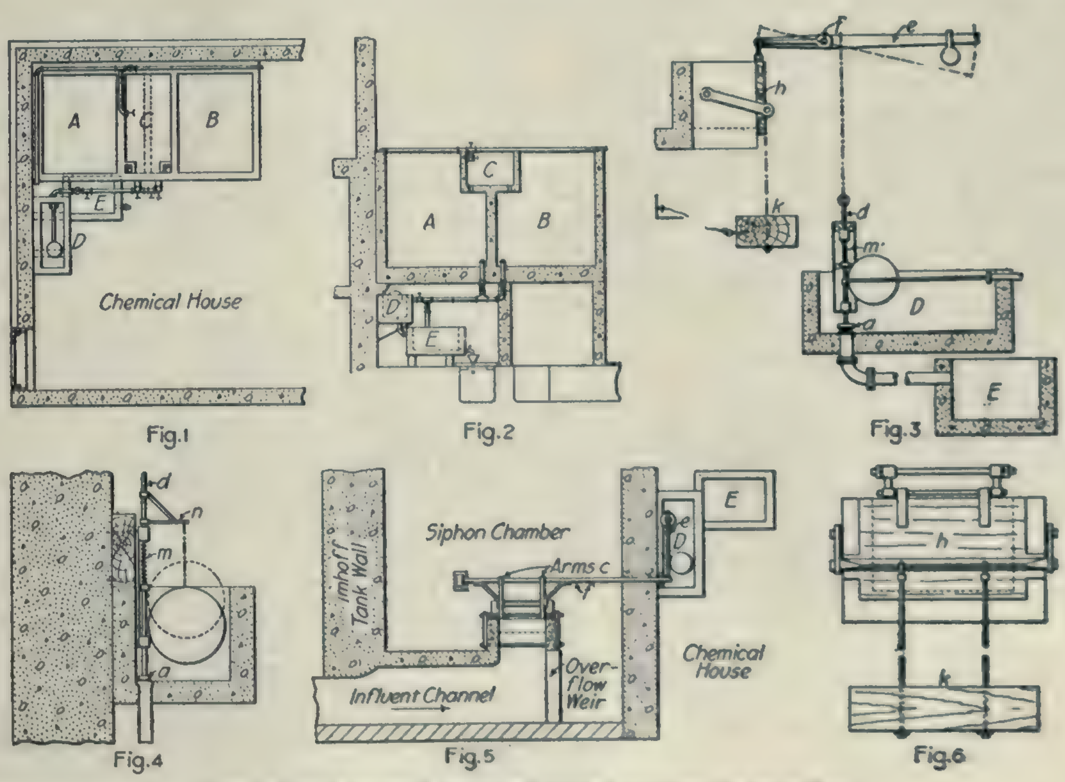

Fig. 1–6. This apparatus proportions chemical application to sewage flow.

nected to a brass rod d, 2 ft. in length. This rod, which is supported in such a manner as to allow a vertical movement, is connected by a chain to a lever e in the loft of the chemical house, which in turn is connected to one end of a revolving horizontal bar f extending through the concrete wall separating the chemical house from the siphon chamber (Figs. 3, 4 and 5). This bar is supported by a concrete pier in the siphon chamber and connected by arms c to a heavy wooden gate, h (Figs. 3 and 6), constructed and supported in such a manner as to give it an oblique movement up and down, when acted upon by the flow of sewage, thereby opening and closing respectively the end of the influent channel (Fig. 5) conveying the effluent from the Imhoff tank into the siphon chamber. It will be noticed that the arms c are on the opposite side of the horizontal bar f from that of the lever e, thus giving them an opposite movement when the bar is rotated. The remaining accessories necessary for the proper operation of this device are a heavy wooden float, k, connected to the wooden gate in the siphon chamber (Figs. 3 and 6), a spiral spring, m, so connected to the brass rod in D as to insure a downward movement (Fig. 4), and a horizontal arm n on this rod to which the arm of the ball float is attached by a chain.

Operating Details

The operation of this device is as follows: We will suppose that the siphon has just discharged the contents of the siphon chamber onto the sprinkling filter—the siphon chamber, therefore, is empty—and the large wooden float now supported by its connections to the wooden gate has, by its weight, pulled the gate down and against the end of the influent channel, thereby closing it. At the same time the lever in the loft of the chemical house has been elevated, thereby lifting the brass rod and cap in D, which opens the outlet at a and allows the contents of hypochlorite of lime solution to flow from D into E, from where it flows into the mixing channel, through which is now flowing the effluent from the sprinkling filter.

At this point of the operation the horizontal arm, n, attached to the rod in D, having been moved up with the upward movement of the rod, now lifts the ball float, by means of the chain connection, and closes the control valve b. As these relative positions are maintained until the rod moves down and closes the outlet in D, it is seen that no lime solution can flow from the dilution tanks into D while its outlet is open.

Ball Float Regulation

The effluent from the Imhoff tank now entering the influent channel cannot flow into the siphon chamber on account of the wooden gate, which, as was stated before, is being held securely against the end of this channel by the weight of the wooden float. It therefore fills the channel until the level of the overflow weir (Fig. 5) is reached. This is merely one side of the channel constructed so as to be 3 ins. less in height than the others. The effluent now overflows into the siphon chamber until in sufficient quantity to raise the wooden float, thus relieving the weight holding the gate in its closed position, and allowing it to be pushed obliquely upward (open) by the head of sewage behind it in the channel. The upward movement of the gate lowers the lever in the chemical house, and allows the rod in D to be forced down by the spiral spring, thereby closing the outlet at a. The ball float has also been allowed to fall, thus opening the control valve b, and allowing the solution to flow into D from the dilution tanks. The solution continues to flow into D until the surface of the same raises the ball float sufficiently to close the control valve, b, and then remains here until the siphon again discharges the contents of the siphon chamber, which releases it as before, the same operation being repeated as described.

Device Used to Measure Sewage in Place of Meter

In the absence of a meter on the force main from the pump house this device is now being used to ascertain the number of gallons of sewage pumped every twenty-four hours. This is accomplished in the following manner: The chloride of lime, after being thoroughly dissolved in C, is diluted in A and B so that in every gallon of solution there is contained 0.0004 gal. of availablechlorine. The intention is to add 1½ parts of available chlorine to every million parts of sewage.

As is seen by the operation of the measuring device just described, each time the siphon discharges the contents of the siphon chamber there is a certain fixed quantity of chloride of lime solution measured and discharged into the sewage. Therefore, as the quantity of sewage discharged by the siphon each time is known to be 1300 gals., in order to add the required amount of available chlorine the arm of the ball float in D has been adjusted so as to close the control valve b when 5.5 gals. of lime solution have flowed into D. Each morning, after the lime has been dissolved and diluted, an accurate measurement of the elevation of the surface of the solution in the dilution tanks is taken and noted, together with the time. On the following morning, at the same time, another measurement is taken, and the amount of solution which has flowed from the tanks in 24 hours computed. This quantity divided by 5.5 will then give the number of times the siphon has discharged, which, multiplied by 1300, will give the number of gallons of sewage discharged or pumped to the plant in 24 hours.

The plant and system entire was designed by C. F. Mebus, of Albright & Mebus, consulting engineers of Philadelphia, and was constructed by P. L. Scholl & Company, of Reading, Pa., under the supervision of Mr. Ludwick, who is now operating the plant for the hospital.

Costs of street repairs in Chicago have been reduced by the municipal asphalt plant. During 1913 asphalt pavements were repaired at a cost of 81.1c. per sq. yd., or 87.1c. per sq. yd. allowing for plant depreciation and interest on investment. At a total cost of $62,637.03 or $1.175 per sq. yd., 53.432 sq. yds. of brick pavements were repaired. Granite block pavements to the extent of 59,345 sq. yds. were repaired at 53.2c. per sq. yd., or a total of $31,593.04. Macadam pavements cost 12.16c. per sq. yd., 1,880,365 sq. yds. having been repaired at a cost of $227,443.03. Of cedar block pavements, 2,595 sq. yds. were repaired at a cost of $524.49, or 20.25c. per square yard.

Scrubbing concrete surfaces with ordinary scrubbing brushes with stiff palmetto or other fibre bristle, with a slight stream of water from a hose or can, will usually be sufficient if the concrete has not set too hard.

Paints Designed to Prevent Electrolysis in Concrete[*]

THE use of a paint as a protective covering for reinforcing steel against damage by electrolysis has often been proposed, but the writer is not aware of any tests having been made to determine a type of coating best adapted for this purpose.

Paints having a high insulating value are generally those drying with a high gloss, which is apt to prevent proper bonding, a fact which has undoubtedly prevented a general use of this protection. A method for overcoming this objectionable feature was developed by these experiments.

Corrosion Causes.—It may be well to review briefly the causes of corrosion in reinforcing steel for the benefit of those not thoroughly familiar with the subject.

The ordinary forms of iron corrosion have been found to be due to auto-electrolysis, the presence of segregated impurities being responsible for differences in potential at certain areas, which set up galvanic action and cause solution and the formation of rust at the positive nodes. A similar but more rapid action takes place when an electric current is passed through an iron anode immersed in an electrolyte, such, for instance, as salt water. When damp cement contains an embedded iron anode the cement acts as an electrolyte, and the same rusting action takes place, regardless of the fact that concrete contains sufficient lime to inhibit corrosion when no electrical currents are present. With the electrolytic change of metal into oxide comes an increase in volume of the products of reaction, and there is developed an enormous expansive force of mechanical pressure, which is sufficient to crack the strongest forms of concrete.

Engineers are active in their endeavors to prevent high voltage currents from running wild, but this fact does not justify a disregard of precautions against stray currents.

Preparation of Specimens and Methods of Testing.—The tests were made on two series of specimens as follows:

1. Rods ½ in. x 12 ins., painted two coats and embedded in concrete cylinders.

2. Rods ¾ in. x 12 ins., embedded as anodes in cylinders of concrete.

All cylinders were 3½ ins. x 8 ins., of cement mortar 1:2. The moulds were removed in 2 days and the cylinders aged for 1 month.

Tests on Series 1 were made by immersing the lower 2 ins. of the specimens in water, connecting them in parallel and passing through them a direct current at 30 v.

Observations were made for 1 week, when small cracks began to show near the bottom on a few specimens.

The specimens were then immersed to within 1 in. of the cylinder tops, the current turned on, and observed for 10 days. Cracking was shown by every cylinder carrying an appreciable amount of current, the fracture starting at the anode.

Wherever the protecting film broke down tre increased passage of current resulted in rapid corrosion of the steel, followed by the expansion and bursting of the concrete cylinder.

Series 2 were tested by placing them in individual earthen jars containing sheet iron cathodes coiled around but not touching the cylinders. The jars were filled witr water to within 1 in. of the top of the concrete.

The cylinders were connected in Series 1 and current passed at 30 v. for 240 hours, when seven specimens developed cracks. The voltage was increased to 55 v., and continued for 60 hours.

Observations on Tests.—In the specimens in which cracking occurred the anodes showed considerable rust, the paint coatings having been broken down. On tre cathodes in Series 1 the paint coatings were still intact, although some had apparently been affected by moisture and the hydrated lime in the wet concrete, chalky surfaces being shown.

The coatings on anode and cathode bars which were embedded in cylinders which did not crack and which carried little current were in a good state of preservation.

Bonding Tests.—In order to determine the comparative bonding strength of rods coated with the various paints a duplicate of Series 2 was made with the exception that the rods were placed flush with the bottom of each cylinder. At 3 weeks the specimens were placed on an iron block drilled with a 1-in. hole and tested in a Riehle[2] testing machine. Some paints that proved to be good insulators failed to show bonding strength, and vice versa. When painting rods in order to overcome the objection to using paints which dry to a gloss surface and prevent proper bonding, these coatings were dusted while tacky (not wet) with sharp particles of sand, which formed a rough surface, assuring a good bond. The corrosion of metal embedded in concrete structures, by stray currents of high voltage, is often productive of serious effects. The use of properly made paints upon such metal constitutes a safeguard that should not be neglected by the engineer. Such paints may be prepared from the following substances:

The vehicle should contain:

Boiled or bodied oils or products which dry to a fairly saturated film.

Oils which dry by semi-polymerization rather than oxidation.

Oils which dry to a flat rather than a highly glossed surface.

The solid portion should contain a percentage of:

Pigments which are coarse and which, therefore, tend to form films having a rough surface.

Pigments which are inert and which do not act as conductors of electricity.

The painted metal should be "sanded," if possible.

The contract for the construction of a plant at Drummondville, P. Q., for the Aetna Explosives Company of Canada, has been let to Westinghouse, Church, Kerr and Company, Montreal. The company, a subsidiary of the American concern, has intimate relations with the Canada Car & Foundry Company, the new plant being erected in connection with the large orders for shells secured from the Russian Government.

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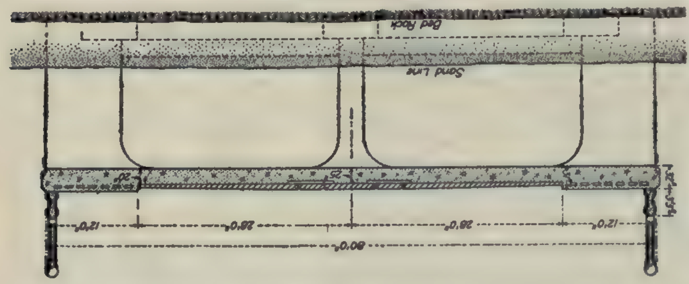
[*] Abstract of paper by Henry A. Gardner, Assistant Director of the Institute of Industrial Research, Washington, D C.

Flat-Slab Bridges which Combine Permanency and Good Appearance

By Walter H. Wheeler[*]

IMMEDIATELY after the disastrous cloudburst and Cherry Creek flood which occurred at Denver on July 14, 1912, it became necessary for the city, in connectoin with the repair work which followed the flood, to consider the construction of four new bridges spanning the channel of the creek. For most of its course through the city the channel is confined by reinforced-concrete retaining walls and varies from 80 to 100 ft. in width, the depth ranging from 10 to 15 ft. The grade of the creek bed is quite steep, causing the water to flow, in times of flood, at a high speed, and there is frequently considerable debris brought down.

To meet these conditions the city desired to construct bridges which would be as nearly permanent as possible and at the same time be ornamental and provide the greatest area of clear waterway for a given elevation of roadway. It was decided to use reinforced-concrete construction and competitive designs and bids were called for on the Market and Larimer Street bridges, situated on opposite sides of the city hall. Designs were submitted for two-span and single-span bridges of the girder, arch and flat-slab types and contract was let for flat-slab bridges of the "mushroom" type. The design gave a clear waterway 10 per cent. in excess of the other designs submitted. Later the city let a contract for a bridge at Downing Street and for one at Curtis Street, in both of which the same system was specified.



Cross-section, showing main dimensions of one of the bridges.

The new bridges give more clearance underneath than the old steel bridges they replace, and the bottoms of the slabs are smooth and do not offer any opportunity for driftwood to catch in passing under and form a dam, as did the steel bridges.

The Downing Street bridge is 80 ft. wide by 106 ft. long over all. The spans between piers, centre to centre, are 45 ft. longitudinally by 34 ft. transversely. The roadway is 56 ft., with a double-track street-car line in the middle, and 12-ft. sidewalks at each side of the roadway. This bridge crosses somewhat obliquely, so that the longitudinal lines of pier centers intersect the transverse lines of centers at about 70 deg., making the perpendicular distance between longitudinal lines about 32 ft. For purposes of computation the spans will consequently be taken as 45 ft. and 32 ft. The bridge is designed to carry a working live load of 150 lb. per square foot over the full area and provides for a moving load of one 75-ton car and one 18-ton road roller on each panel, plus ordinary vehicle and foot traffic. The rails of the car tracks are carried on Carnegie 5½-in. steel ties embedded in the concrete of the slab. The roadway is paved with 3½-in. 16-lb. creosoted wood blocks, manufacturers' standard specification, laid on a 1-in. sand cushion. The slab is 20 in. thick at the gutter, 25 in. thick at center of roadway, 31 in. at inside edge of sidewalk, and 32 in. at outside edge of sidewalk. There are three rows of three columns or piers each crossing the stream, a middle column of each row in midstream. The center midstream pier is 36 in. square; the two outside midstream piers are built oblong in section and are 3 ft. wide by 9 ft. 6 in. long, the idea being to bring the piers out flush with edge of the bridge and give the spans, when viewed from the side, the appearance of a flat arch. The six end piers are 42 in. square.

All piers are carried down to bedrock and anchored thereon with four 1⅜-in. round rods extending 4 ft. into the rock and grouted. Bedrock at Downing Street averaged about 5 ft. below the Creek bed, at Market Street about 15 ft. The bedrock is shale and the footings of the piers are proportioned for a bearing on the rock of about 8 tons per square foot when the bridge is fully loaded. Embedded in each sidewalk 24 in. above the bottom of the slab are 7 lines of 4 x 12-in. hollow tile, spaced 18 in. on centers, for wire conduits. At each end of the bridge a thin wall is carried down flush with the edge of the bridge to the top of the retaining wall to carry out the flat-arch effect.

Reinforcing

The reinforcing in the slab consists of belts of rods running in four directions, between piers, with 16-ft. laps in every belt at each mushroom head. The belts are 16 ft. in width, which is the width of the "mushroom" heads on the piers. These heads are made exceptionally stiff, having twice the usual number of radial and ring rods. The outer edges of the slab are carried as a cantilever and reinforced with supplementary rods running longitudinally near the edges of the slab. There is also supplementary reinforcing in the sidewalk near the surface. The columns or piers are reinforced with vertical rods and spiral hooping. All steel is plain round bars, manufacturers' standard specifications for structural grade.

The wearing surface of the sidewalks is floated smooth and blocked off in squares. The hand railing and lamp posts are of ornamental cast stone manufactured by the National Stone Manufacturing Company of Minneapolis, and are laid up in cement mortar.

The writer is not aware that any tests have been made on the bridge since its completion, but it has been in actual service about two years. The construction work was done during the winter with the thermometer registering as low as 20 deg. below zero at times. Artificial means were employed to prevent the concrete from freezing. The water used in mixing, as also the aggregate, was warmed, and salamanders were kept fired under the slab for a period of about three weeks after casting.

Referring to Dr. Henry T. Eddy's book, recently published, entitled "The Theory of the Flexure and Strength of Rectangular Flat Plates, Applied to Reinforced-Concrete Floor Slabs," and applying his formula, it will be noted that the width of the belts of rods in the slab of the Downing Street Bridge should be such in the mushroom system as to make them cover practically the entire area of the slab, which is found to be the case in this design, although, by reason of the obliquity of the bridge, this width is some 10 in. less than $7 (L_1 + L_2)/32$, which would have been required in case of rectangular panels for the "mushroom" system, where L_1 equals longitudinal span and L_2 transverse span. Applying his formula and assuming a deed load for the slab of 350 lb. per square foot and a live load of 150 lb. per square foot distributed over the full area of one panel, which equals a total load of 720,000 lb. evenly distributed, we find f_s, the stress on the steel, is about 8300 lb. per square inch, and under a test load of double the working load f_s equals about 10,800 lb. per square inch at the middle of the 45-ft. span.

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[*] With C. A. P. Turner, Consulting Structural Engineer, Minneapolis.

The number and length of the laps over the columns reduce the unit stresses in the steel over the edge of the caps below that at midspan. Were four times the live load placed upon the bridge, the greatest unit stress in the steel would be only 15,800 lb. The factor of safety may, consequently, be taken as more than 4.

Again applying his formula for the deflection at the center of the panel, we find, under a test load of 300 lb. per square foot evenly distributed over the full area of a panel, the deflection at the center would not exceed 0.18 in., which is less than 1/3000 of the span. But this formula is one derived to compute actual deflections for heavy loads only where the unit stresses in the steel are 20,000 lb. or more, and give results much in excess for small loads. On this account and owing to stiff sidewalks over 30 in. deep, longitudinal car rails, and pavement, it is probable that no deflection could be detected under test load.

Assuming the neutral axis to be at the bottom of the slab at the edge of the pier the maximum stress on the concrete on the center of theslab, computations show that caps is everywhere less than 700 lb. per square inch, the allowable working stress.

From the above it will be seen the stress values for concrete and steel used in designing the slab of this bridge are very conservative. It will also be noted that the formulae used in obtaining the above values for stress in steel and concrete are applicable only where the stiff column heads of the "mushroom" system are used.

The Downing Street bridge was constructed by the C. P. Allen Contracting Company of Denver. The concrete for all piers was cast up to sand line before the centering for the slab and the remainder of the piers were erected. The balance of the bridge was cast in one operation, but not continuous, the slab being divided into panels, so that one panel with its piers could be completed in a day's run, all joints in the slab being made at the centers ofspans, using temporary wooden bulkheads to secure smooth vertical joints. The concrete was all machine mixed and placed with two-wheeled carts.

Centering

The centering for the slabs consisted of 6 x 12-in. posts spaced about 8 ft. 3 in. on centers both ways, carried on 12 x 14-in. mud sills and sway-braced both ways with 3 x 6-in. bracing. Stringers 12 x 12 in., of Oregon pine, were laid directly on the posts, and 2 x 12-in. Oregon pine joists laid over the stringers 12 in. on centers, with 1-in. sheeting over the joists. Very little cutting of the form lumber was necessary because of the flat slab without beams, and the salvage on it to the contractor was therefore exceptionally large.

Mud sills were used instead of piling, as ordinarily Cherry Creek carried very little water in the winter time, and it was expected the work would be completed before the usual spring freshets. The specifications provided that the slab centering should remain in place for not less than sixty days. The work was delayed somewhat in starting, which brought the casting of the slab later in the spring than was expected, and about thirty days after casting an unusually early freshet cut away the sand under the mud sills, allowing the forms to settle several inches. As far as could be observed, however, there was no settlement in the slab. This practical test clearly shows that the concrete when properly cured is far from overstressed, as it is now probably three times as strong in compression as it was thirty days after casting, and should carry five times the full working live load as easily as it then carried its own dead load.

The contract price for the bridge, plus the cost to the city of reinforcing diagrams, steel and artificial stone, was about $17,400. This did not include the track work, which was a separate item and paid for by the Denver City Tramway Company. As the bridge is constructed it is absolutely independent of any end abutments or retaining walls, and approaches and retaining walls, could be entirely washed away and the bed of the creed scoured down to bedrock without injury to the bridge. In the event of a flood passing over the top railing and lamp standards might be injured, but could be easily and comparatively cheaply replaced. The stone railings might wash away if submerged by a flood and leave only the relatively thin slab impeding the flow of the water, which would tend to cause only slight overflow. The weight of the bridge itself adds greatly to its permanency.

The total contract price for the Market Street bridge was $17,150; for Larimer Street bridge $17,850. The contract price of the Curtis Street bridge plus cost to city of reinforcing diagrams, steel and artificial stone was $12,300. On all four bridges the writer acted as engineering agent for C. A. P. Turner of Minneapolis, designing and furnishing the reinforcing steel and artificial stone.—Engineering Record.

A draft of a new ordinance to govern fireproof construction of buildings in New York City, prepared by a committee of the Board of Aldermen, with Mr. R. P. Miller as expert, contains the following rule for determining the safe carrying capacities of concrete-slab floors: "The gross load in pounds per square foot of floor space shall not exceed the product of the depth in inches of the reinforcement below the top of the slab, by the cross-sectional area in square inches per foot of width of the tensional steel, divided by the square of the span in feet, all multiplied by the following coefficients: When cinder concrete is used 14,000 if the reinforcement is not continuous over the support, 18,000 if the reinforcement consists of rods or other shapes securely hooked over or attached to the supports, and 26,000 if the reinforcement consists of steel fabric continuous over the supports; and when stone concrete is used, 30,000 and 40,000 respectively." The rule is a portion of a revision of the city's building code, now in progress.

Depositing Concrete Under Water

CONCRETE is deposited under water in several ways, such as in paper bags or open cloth bags, through pipe tremie and by boxes properly built to dump concrete after being lowered to bottom. Very commonly it is deposited by means of concrete buckets with trip-line arrangement whereby the catch on the bottom of the bucket is released and the concrete flows out when the bucket is raised. It may be said in general that on each job some one method is the best. The proper method may be determined by physical conditions, by the size of the job, or by some other condition. For example, where concrete is to be placed about a cluster of piles which are close spaced, in such case there will be loss of time in lowering the bucket so as to miss the piles, or the piles may be too closely spaced to allow an ordinary sized bucket to be lowered between them, making a special size bucket necessary if it is to be used. Where it is considered essential that the concrete clutch the piling I would hardly care to risk the paper or cloth sacks. In the above example a pipe tremie would be best. Consider the job which is too small to warrant much equipment. In such case, it might be best to use the cloth or paper sacks filled with concrete as this could be done with little outlay. If for some reason it is not desirable to use them, then a tremie may be rigged up at comparatively small cost.

Attaching Machinery or Piping to Concrete Floors

THE following is an extract from an address by Mr. Leonard C. Wason (President Aberthaw Construction Company, Boston) delivered before the National Association of Cotton Manufacturers:

It is an easy matter either to embed insets in the floor for attaching shafting, piping, etc., in a pre-arranged method, or to insert these so that timbers can be bolted to them and allow an elastic method of attachment. Again, it is fairly simple to drill holes for the insertion of expansion bolts, where no previous provision has been made. The cost of setting these inserts varies with their style, but for material and labor may be said to run between five cents and ten cents each. They can be attached as readily to corrugated iron, which is to-day very extensively used for form work, as to the wooden panels which were used most extensively some years back. Corrugated iron is much cheaper to use for form work than wood panels, and the writer thinks it makes a much better looking ceiling.

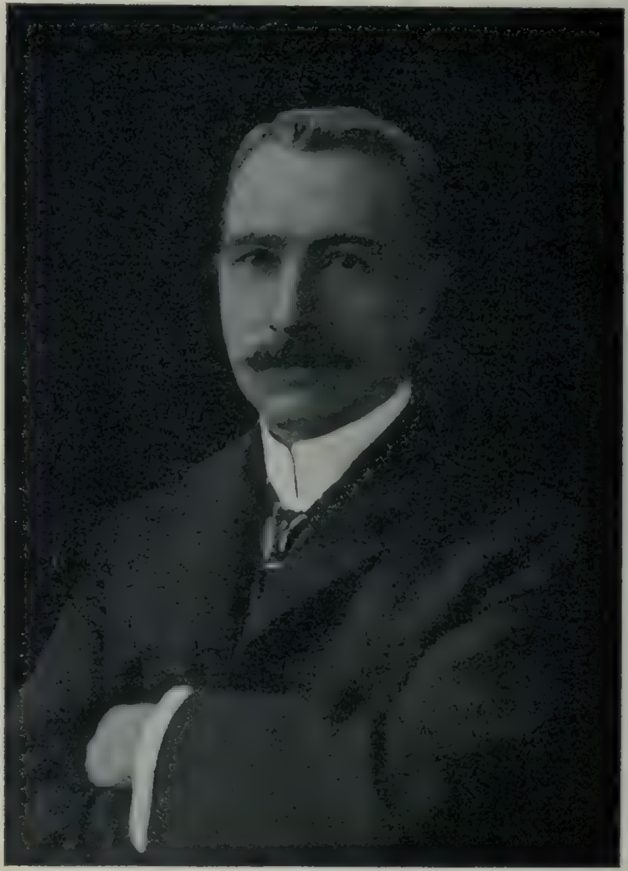
The following short list gives, according to a Pittsburgh newspaper, the total number of church edifices built in the United States area during the seventeenth century which have escaped the destroying hand of time, and the more destructive neglect and indifferent attitude of man: St. Luke's, Smithfield, Va., 1632, a brick building, of which Joseph Bridger was the architect; the Ship Meeting House, so called because it was built of ships' timbers, at Hingham, Mass., 1681; the Quaker Meeting House at Flushing, 1692; "Gloria Dei," Swedish, Philadelphia, 1697; Trinity, Wilmington, Del., and the Dutch Reformed Church at Oakland, N.J., both built of stone in 1698.

Personal Mention

Mr. James Ballantyne, ex-President of the Montreal Builders' Exchange, and Mayor of Montreal West, has been made a Justice of the Peace for the District of Montreal.

Mr. Malcolm H. MacLeod

Mr. Malcolm H. MacLeod, of Winnipeg, to whom we have pleasure in introducing our readers, is General Manager and Chief Engineer of the Canadian Northern Railway. He was born at the Isle of Skye, in the County of Inverness, Scotland, fifty-eight years ago, and came to Canada as a child. He has been engaged in the location and construction of various railways since 1878, and is considered one of the best informed railway men on the continent. Prior to making connections with the C. N. R., he was Chief Engineer in the Crow's Nest Division and later superintendent of operations in the same district for the Canadian Pacific Railway. He left the service of the C. P. R. to accept the appointment of Chief Engineer for the Canadian Northern Railway. This was in 1900. He was appointed to his present office as General Manager and Chief Engineer in 1907. A few years ago, upon the occasion of the visit of H. R. H. Prince Arthur of Connaught, Mr. MacLeod was presented by the Prince with a handsome testimonial as a mark of recognition of the genius behind the C. N. R. system.


Mr. Malcolm MacLeod, of Winnipeg, General Manager and Chief Engineer of the Canadian Northern Railway

Mr. A. J. Matheson, of the firm of Cartwright, Matheson & Company, consulting engineers, Vancouver, left the West recently for the Federal Capital. Mr. Matheson has been appointed a member of the Commission recently named by the Dominion Government to investigate the water levels in Montreal Harbour. The Commission will begin work at once, and the investigation will take about two years. The members of the Commission are Mr. W. J. Stewart, of Ottawa, Chief Hydrographer for the Dominion; Dean Haskell, of McGill University, and Mr. F. W. Cowie, Engineer for the Montreal Harbour Commission. An inquiry will be made into all the factors affecting the water levels at Montreal, such as the inflow from the Ottawa River, the power dams at Cedar Rapids, Cornwall, Coteau, etc., and the Chicago drainage canal. Methods to prevent the annual ice jams in the St. Lawrence channel will also be studied.

Mr. H. B. VanEvery has been appointed Canadian representative of the S. Morgan Smith Company, of York, Pa., manufacturers of hydraulic turbines and accessories. His office is in the Power Building, Montreal.

A number of prominent contractors were in Toronto last week for the purpose, it is reported, of conferring with the directors of the Canadian Northern Railway. The visitors included Mr. P. Welch, of Spokane, Mr. J. A. Stewart, of Vancouver, and Mr. T. W. Horne, of Fort William.

Mr. J. R. MacLeod, who has done excellent work for the city of Montreal, as tramways and railways engineer, has been appointed head of the Sewers Department, in succession to Major Stuart Howard, retired on a pension. Mr. MacLeod will combine the two offices. Mr. Alex. Martin has been made Assistant Chief Engineer to Mr. Mercier, Acting Chief Engineer. Mr. G. Janin, the head of the engineering department, is at present on active service in France.

Mr. Joseph R. Henderson of Montreal, President and General Manager of Brandram-Henderson, Limited, died suddenly at Halifax on July 31st. Mr. Henderson was a native of Hexham, Northumberland, Eng., and came to Canade when eighteen years of age. After three years of farming, he entered the service of an Ontario firm of paint and oil manufacturers. From that time on he was engaged in that line of business, eventually forming the present company in conjunction with Brandram Bros. and Company of London, Eng.

Col. Cantley, President and General Manager of the Nova Scotia Steel and Coal Company, states that the shipping of the two thousand cars which the company are now manufacturing for the Russian Government will begin next month. All arrangements for the transport of the cars to Vladivostok have been completed. The iron and steel plants of the company at Sydney and New Glasgow are now running at full capacity, and Col. Cantley says the payroll at the present time is the largest in the history of the company, $59,000 having been paid out in wages during the last fortnight, which is at the rate of $4,000 a day. When the order for the Russian Government is filled, the company will begin the manufacture of one thousand cars for France. Negotiations for further war orders are under way.

Mr. R. T. Stull, E. M. Cer., has become associated with the Dunn Wire-Cut-Lug Brick Company, of Conneaut, Ohio, as its ceramic engineer. His special duty will be to advise with the licensees of the Dunn Company, and help them with their brick-making problems. Mr. Stull is widely known as the author of numerous contributions to ceramic literature, as well as in practical and educational fields. He is a graduate of the Department of Ceramic Engineering at Ohio State University, and for five years was connected with various important ceramic industries as superintendent. He became Instructor in Ceramics in the University of Illinois, in 1907, and has been connected with that institution continuously since that time. In August, 1913, he was advanced to position of Acting Director of the Department of Ceramic Engineering. He is a member and Vice-President of the American Ceramic Society, a member of the American Chemical Society, American Society for Testing Materials, National Brick Manufacturers' Association, and the Illinois Clay Manufacturers' Association. He is also a member of the Honorary Scientific Society of Sigma Xi, Alpha Chi Sigma, and Keramos. In engaging the services of Mr. Stull the Dunn Wire-Cut-Lug Brick Company was influenced by a desire to give its licensees the benefit of the highest scientific assistance in perfecting the quality of their brick. This is an extension of the policy of the company as already developed in the maintenance of a corps of expert engineers who are supervising the constructional work.

Mr. A. R. Decary

Mr. A. R. Decary, consulting engineer and architect, Quebec, P. Q., is well known as the superintending engineer for the Provincial Department of Public Works. He was born at Montreal in 1875 and was educated at Laval University, beginning practice in Montreal. He was appointed Engineer in the Department of Public Works in 1899 and was nominated a few years later District Engineer of the same department. He became Superintending Engineer for the province two years ago. Mr. Decary is a member of the Canadian Society of Civil Engineers and is a past president of the Quebec Branch of that body. He is a Fellow of the Royal Architectural Institute of Canada and is a member of the Province of Quebec Association of Architects and also of the Quebec Geographical Society. In these times it is of interest to note that he entered the Army Service Corps in 1906 and was transferred the following year to the Corps of Guides as Special Service Officer.

Mr. A. R. Decary, F.R.A.I.C., Quebec, P.Q.

The Contract Record would like to get in touch with a thoroughly competent building and contracting superintendent capable of showing efficiency in the handling of a $100,000 or $150,000 contract, buying supplies, controlling labour, and so on. The inquiry is from Ottawa.

Mainly Constructional

East and West—From Coast to Coast

Ninety-three permits issued last month in Winnipeg represented an expenditure of some $200,000.

A London, Ont., firm, John Hayman & Sons, are the contractors for the $30,000 addition to the Ingersoll factory of the Borden Milk Company. We are informed that operations are to be started forthwith.

The Phoenix Bridge and Iron Works, Limited, are to be congratulated on securing the contract for the $200,000 extension to the Harrison Bakery at Westmount. The new building is to be three storeys high, 265 x 140 feet in dimensions, of brick and steel construction.

Good progress is being made on the new building which is being erected on University Avenue, Toronto, for the Provincial Hydro-Electric Commission. At present the walls are about finished. The new building is to be six storeys high, with basement, and the construction is to be of steel, terra-cotta, and brick. The estimated cost is $200,000. Messrs. Witchall & Son are the general contractors.

If the local "Herald" can be termed an authority, the building trades at Stratford, Ont., are brisk, in spite of the war. Among the larger buildings now under construction are the Diebel Furniture Factory, the Bartlett Automobile Factory, a garage for McDonald & Henry, and a considerable amount of residential work. Local contractors are reported to be optimistic about the amount of work that will yet be done before the snow flies.

Plans for a sewerage scheme for the town of Chambly Basin, P. Q., have been prepared by Mr. J. A. Gravel, of Montreal. It is proposed to construct 34,000 feet of sewers, and to pump the sewage by means of two electrical pumps of a total daily capacity of a million gallons into the Richelieu River, the pumps being operated by current supplied by the Montreal Light, Heat, and Power Company. The sewage will be carried from the pumping station by means of steel pipes which run 700 feet into the river. The town is also to construct 80,000 square yards of cement sidewalk.

The Banque Nationale, of Quebec City, have decided to rebuild their premises, and on the instructions of the directors, the plans have been drawn up by Mr. Emile Tanguay. The building, on St. Peter Street, will be six storeys high, and will be 120 feet above the level of the ground, the site being 60 x 66. The basement and first storey will be constructed of granite, and the remainder of Deschambault stone, with a steel frame. The Bank will occupy the lower portion of the building, five storeys being utilised for general offices. The plans provide for dining rooms for employees.

In British Columbia gangs of approximately one thousand one hundred men are now engaged in putting the finishing touches to the C. N. R. line. It is predicted that so far as the track is concerned the company will be in a position to run trains over its entire system from the Atlantic to the Pacific by October 7th. Construction work is proceeding apace on the station buildings, roundhouses, water-tanks, and other structures. Traffic on the section of the line from Port Mann to Hope, on which a tri-weekly service is being operated, is showing satisfactory results. A number of small industries are opening up at points along the line, and the indications are that the business will exceed expectations.

The contract for asphalt has given the city of Montreal considerable trouble this season. The first contract was stopped by the Court, on the ground that the Controllers exceeded their authority, and it was then decided to call for fresh bids. Two offers were seriously considered, that of the Aztec Oil and Refining Company at $15.50 per ton, and that of the Warner-Quinlan Asphalt Company at $14.25 per ton. It was proposed to divide the contract, but this was objected to; and in the course of discussion, it was asserted that the Aztec Company would take legal proceedings if the tender of the opponents were accepted, on the ground that all the conditions had not been fulfilled. The Controllers, however, decided to accept the bid of the Warner-Quinlan Company, that being the lowest, after the analysts and Mr. P. Mercier, the Acting Chief Engineer, had recommended to that effect.

A decision just rendered by the Railway Commission is of interest to municipalities and to those concerned with the Good Roads movement. Application had been made to the Board requesting it to order that low commodity rates should be extended by the railway companies for the transportation of gravel so as to enable the municipalities of Western Ontario to proceed with the work of general road improvement at a reasonable expense. The Chief Commissioner, after hearing the evidence, makes the announcement that the railways will carry in the territory in question gravel required by the municipalities at a flat blanket rate of fifty cents a ton for any distance up to and including fifty miles. The concession is made in the light of public policy, and the possibility of increased railway business as a result of the added prosperity, and with the understanding that the rates offered are not to be regarded as indicating sufficient rates for similar commercial service.

Bulletin 108 of the Lackawanna Steel Company (H. A. Drury Company, Limited, Montreal, general agents for Canada) describes fully and illustrates clearly and attractively the arched-web, straight-web, centre-flange, protected and plate types of steel sheet piling, which have been developed theoretically under the direction of the inventors and an able engineering staff, and have been brought to a high state of mechanical efficiency in mills which have long enjoyed an enviable reputation for the quality of their entire output. The Lackawanna Steel Company maintain a Steel Sheet Piling Engineering Department to furnish reports, suggestions, and tentative plans to assist in the correct and economical use of their product in the many forms of construction for which it is adapted. The catalogue is illustrated by many excellent half-tones and diagrams, and not only the contractor, but the engineer, will find in it much that is interesting and informative.

"Lumina" solid steel windows, doors, and partitions are described in an attractive illustrated catalogue issued by the Detroit Steel Products Company, Detroit, Mich. These windows are claimed to give the maximum amount of natural light, and to have many advantages, both from a mechanical standpoint and from that of investment. Perhaps the outstanding advantages may be stated to be maximum daylight, perfect ventilation, simplicity, and low cost. "Lumina" solid steel windows are installed in scores of the most modern factories on the continent, and among others in the following Canadian plants: B. C. Electric Railroad Company, Vancouver; Detroit-Windsor Ferry Company, warehouse, Windsor, Ont.; Edison Illuminating Company, Sandwich, Ont.; Ford Motor Company of Canada, Service Station, Montreal; Ideal Concrete Machinery Company, Windsor, Ont.; Michigan Central Railroad Company, St. Thomas, Ont.; National Wire and Spring Company, Windsor, Ont.; Stearns Laundry, Windsor, Ont.; Sydney Stephenson, Planet Building, Chatham, Ont.; Arcadia Coal Company, Silverton, N. S.; and Chicoutimi Water and Electric Light Company, Pt. Arnold, Que.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Belleville, Ont.

Granolithic walks have been authorized along West Coleman, East Chatham, Howard, and a portion of Moodie, Boswell and West Bridge Streets. City Engineer, J. W. Evans; Clerk, J. W. Holmes.

Calgary, Alta.

The projected paving on Seventeenth Avenue has been turned over by the City Council to Commissioner Garden and City Engineer George W. Craig to report. City Clerk, J. M. Miller.

Hamilton, Ont.

Work is to start at once on the asphalt pavement to be laid along Spruceside Avenue by the Board of Control at a cost of $4,887. Material required will be purchased by A. Kappelle, Secretary of Works Department. Clerk of Board of Control, S. H. Kent. Engineer, A. F. Macallum. Day labor.

Listowel, Ont.

A by-law is to be submitted by the Town Council for the installation of a water-works system to cost $5,400. Mayor, A. W. Featherstone. Town Clerk, William Bright. Vote will be taken on August 21st.

Matheson, Ont.

The rate-payers have approved a by-law to secure a water supply from White Fish Lake at a cost of $20,000. Town Clerk, E. B. Sanders; engineers, McAustan & Anderson, North Bay.

Meaford, Ont.

A by-law for street improvements is to be submitted by the Town Council. Estimated cost, $10,000. Town Clerk, C. G. Albery.

Millardville, B. C.

Tenders are to be called soon by the Municipal Council of Coquitlam for the supply of material for water installation, the work to be done by day labor, under Constructing Engineer F. L. Macpherson. The Municipal Engineer is Engineer Burnaby, and the Reeve is Mr. Marmont.

Minto Township, Ont.

Tenders are open and will be received by the Township Clerk until noon, August 16th, for the construction of municipal drain No. 6, length 16,000 ft., containing approximately 12,500 cubic yards of excavation. Plans and specifications at the office of the Clerk.

Montreal, Que.

Tenders will be received by the City Council (Secretary, L. N. Senecal) until August 12 for the supply and delivery of paving blocks. Specifications at office of Superintendent of Purchases and Sales, City Hall.

North Grimsby, Ont.

Grimsby Village and North Grimsby Township are having plans prepared for the installation of a water-works system at a cost of some $5,600. For particulars address E. Bromley, Clerk, Grimsby P. O.

North Vancouver, B. C.

The Board of Works has recommended that Robson and Keith Roads be repaired from Berwicke to McKay, to connect with Marine Drive in West Vancouver. Clerk, J. Cowlins; Engineer, A. M. West.

Ottawa, Ont.

Work is about to be started by the City Council on the construction of a sewer along Carruthers and other streets at a cost of $9,769, the length to be 1,400 lin. ft. and the work to be done by day labor. Mayor, N. D. Porter; City Engineer, F. G. Askwith.

Paris, Ont.

A by-law to raise $4,000 for various purposes, including the construction of a concrete bridge on William Street, and the purchase of gravel pits, is to be submitted to the rate-payers. Clerk, Thos. McCosh.

Peterboro, Ont.

Tenders are open for castings, and will be received by the City Engineer until August 11th, for period up to March, 1916. Engineer, R. H. Parsons; Clerk, S. R. Armstrong.

Rossland, B. C.

The City Council contemplates the construction of a sewerage system along First Avenue, between St. Paul and Monte Christo Streets. The matter was referred to committee for report at next Council meeting.

Simcoe, Ont.

Plans have been drawn for two sewage disposal beds, 100 x 200. Submitted to the Provincial Health Department for approval. Mayor, W. Williamson. Town Clerk, W. C. McCall.

Stratford, Ont.

The public Utilities Commission have approved the laying of 1800 feet of 6-in. water-main and 300 feet of 2-in. mains to the Agricultural Park.

Sudbury, Ont.

Sewer extensions, etc., have been authorized, along Elm, Cedar and Larch Streets. Town Clerk, W. J. Ross.

A by-law authorizing granolythic pavements on certain streets has been passed. Town Clerk, W. J. Ross.

Toronto, Ont.

The City Council will pass on a by-law on August 23rd having for its object the widening of Lansdowne Avenue. The amount of the proposed expenditure has not yet been made public. R. C. Harris, Commissioner of Public Works.

The Commissioner of Works (R. C. Harris) has presented to the Board of Control a report in connection with the Morley Avenue sewage disposal system. The recommendations call for the installation of Imhoff tanks at a cost of $6,000,000, sprinklers costing $3,287,000.

York County, Ont.

Work is to be commenced at an early date on road improvements promoted by the County Council (Clerk, R. W. Phillips, 57 Adelaide Street E., Toronto; Engineer, F. Barber, same address). Improvements to be undertaken are as follows: Yonge Street from Richmond Hill to Holland Landing; Eagle Street into Newmarket, continuing through Queensville, Sharon, Keswick, Bellhaven and Sutton to Pefferlaw. West York Ninth Concession of Schomburg.

CONTRACTS AWARDED

Broadview, Sask.

The waterproofing contract in connection with the building of the concrete subway for the Canadian Pacific Railway has been awarded to the Canadian Asphalt Company, of Winnipeg.

Brockville, Ont.

The City Council has awarded the contract of $4,600 for the intake pipe to the Donnelly Wrecking Company, Ogdensburg, N. Y. The work will consist of laying 800 ft. of intake pipe out into the river. City Engineer, Geo. Bryson, Victoria Hall; City Clerk, Geo. H. Dewey.

Chambly Basin, Que.

The Municipal Council (Engineer, J. A. Gravel) have awarded to S. W. Hamilton, of Montreal, the contract for sewer and steel pipe and pumps.

Fraserville, Que.

The contract for the concrete reservoir has been awarded by the Town Council to John Martin, Fraserville, at $8 per cu. yd. Town Clerk, Mr. E. Talbot.

Lancaster Parish and St. John, N. B.

The contract for excavation, refilling of trenches and building of sewers, at a cost of $5,000, has been awarded by the Sewerage Board to Kane & King, 93 Prince William Street, St. John, N. B. Chairman of the Board, W. H. Golding, Fairville, N. B.; Secretary, J. K. Kelly, Prince William Street, St. John, N. B.

Montreal, Que.

The City Council have awarded a contract for 5,000 tons of asphalt to the Warner Quinlan Asphalt Company, of this city.

Niagara Falls, Ont.

The contract for the construction of a vitrified brick pavement on Queen St. has been awarded to C. H. Kumeyer, of this city, at $9,244. The City Clerk of Niagara Falls is Mr. W. J. Seymour, and the City Engineer Mr. F. J. Anderson.

P. A. Lorenzo has obtained the contract for reinforced concrete paving on Robert Street, at $4,215.

St. John, N.B.

The contract for the 6-in., 8-in., 10-in.

and 24-in. cast iron pipe, at $33 per ton, has been awarded to Vroom & Arnold, Bank B. N. A. Building. Engineer, William Murdock.

Toronto, Ont.
The Board of Control has awarded the contract for the Queen Street and Kingswood sewer to McLaren & Company, Barrington Avenue, and for the Jones and Boultbee Avenue Sewer to Commissioner of Works, R. C. Harris, City Hall.

Railroads, Bridges and Wharves

Arden, Man. (over White Mud River)
Work is to be started at once by the Municipality of Lansdowne on the reinforced concrete bridge, at a cost of $5,600, 1 span, 90 ft. over all, the roadway to be 18 ft. The general contractor is Alex. Scobie, care Secretary-Treasurer, M. E. Boughton, Arden.

Canwood, Sask.
Work is to be started soon, under a Board of Directors, on the erection of an elevator. The Board is composed of the following: A. Mcowan, President; A. Hawkesworth, Secretary - Treasurer; Messrs. Wahl, Quellette and Gordon, Directors.

Notawasaga Twp., Ont.
Work has been started on the $3,000 bridge for the Simcoe Council by McDougall & Tool, general contractors, Midland, Ont. The County Clerk is R. J. Fletcher, Barrie, Ont.

Puttown, Ont. (near River Nith)
New tenders are being called by Brant and Oxford Counties for the $7,000 Bridge, 1 span, 150 ft. long, 16 ft. wide, steel and reinforced concrete construction. Tenders will be received by the Clerk of Brant County, A. E. Watts, K. C., Brantford, until noon, August 14th. The specifications and plans are with the engineers, Jackson & Company, Temple Building, Brantford.

St. John, N. B.
Tenders are open and will be received by the Provincial Government Department of Public Works until noon, August 18th, for the dismantling of the old suspension bridge at St. John, N. B. Minister, John Morrissy, Fredericton. Specifications at Public Works Department, Fredericton, Provincial Government Rooms, St. John, N. B., and Structural Engineering Company, Limited, 503 New Birks Building, Montreal.

CONTRACTS AWARDED

Province of New Brunswick
The contract for the bridge at Moosehorn Brookmouth has been awarded by the Provincial Government Department of Public Works to E. Smye, Norton, Kings County, N. B.

Public Buildings, Churches and Schools

Aroostook Junction, N.B.
In connection with the four-roomed brick school which is being erected here at a cost of $7,000, the architect and general contractor, S. L. Steeves, Woodstock, N. B., will purchase building materials and also school equipment, desks, etc.

Cochrane, Ont.
The walls of one storey of the new $40,000 school are up. The contractor is W. G. Hunt, Box 408, Cochrane, who is putting up the school for the School Board, of which W. D. McDouglas is Secretary. The architects are Angus & Angus, McCool Building, North Bay. Sub-contracts are let as follows: heating and plumbing, Taylor Hardware Company; wiring, Ward and Ainsworth, Cochrane.

The foundations are laid for the Town Hall and jail building, the estimated cost of which is $4,000. Van Rassel Bros., Cochrane, are the general contractors, the plumbing and heating being carried out by C. S. Giles, Cochrane, and the wiring by Ward & Ainsworth, Cochrane. Town Clerk, H. J. Brown.

The foundations are in for the hospital under construction for the Cochrane General Hospital by Van Rassel Bros., Cochrane. The estimated cost of the building is $7,222.50. Plumbing and heating is being carried out by Farrell Engineering and Heating Company, Cassells Street, North Bay, at a cost of $2,150. The wiring is by J. Read, Cochrane, at $150.

Colborne, Ont.
The foundations are in of the Fire Hall and Lock-up. The work is to be done by day labor. Material and equipment will be purchased by Reeve Samuel D. Dudley and Councillors R. Snetsinge and B. H. Boyle. City Clerk, H. S. Keyes; engineers, W. J. Jamieson. The building will be of cement block construction.

London, Ont.
Plans have been drawn for the erection of the church owned by the Latter Day Saints Congregation, 340 Maitland Street, at an estimated cost of $9,500. The owners are doing the general contracting, but may sub-let some trades. The construction includes one storey, 44 x 66, solid brick, concrete foundation, slate roofing, hot air heating, maple and pine floors, lime and sand plastering, wood lath. The architect is J. V. Munro, Bank of Toronto Chambers.

Maidstone, Ont.
The walls have been started of the $7,000 school under construction by David Croft, Maidstone, who will purchase material. The construction consists of one storey and basement, 34 x 40, brick construction. The Secretary of the School Board is Wm. Pettypiece, Pacquette Station. Architects, G. Jacques & Company, Bough Building, Windsor.

Metchedash and Tay Townships, Ont.
Work is to be started on the school for S. S. No. 8, the Secretary of which is Mr. W. H. Lovering, Lawson P. O. The contract was awarded to J. Orton, Front Street, Orillia. The mason work is to be done by Leigh Brothers; carpentry by Geo. Whitney and Lamb, Orillia; cement work by O. Cudworth, Orillia, and heating and plumbing by Purdy & Company, Mississaga Street W., Orillia. The general contractor is doing the interior fittings. The architect is J. H. Robertson, Orillia. The estimated cost is $4,500.

Montreal, Que.
The foundations are in for the alterations to the school at Greenshields, near Abraham. The owners are the Protestant Board of School Commissioners, Belmont Street; general contractor, M. Jeal, 263 Pine Avenue East. Estimated cost of alterations $3,400, to be of one storey, 45 x 50, concrete foundation, felt and gravel roofing.

Ottawa, Ont.
Tenders will be received until August 17 by R. C. Desrochers, Secretary Department of Public Works, for the partial removal of the tower of the Victoria Museum. Plans and specifications at offices of Thos. A. Hastings, Postal Station "F," Toronto, R. L. Deschamps, Dominion Buildings, Montreal, and the Chief Architect of the Department of Public Works at Ottawa; also at the office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Port Colborne, Ont.
Tenders will be received until August 16 by C. M. Borter, architect, for the erection of a two-storey eight-roomed, brick school for the Board of Education. Estimated cost, $35,000. Plans and specifications with architect, and with Secretary of the Board, D. Alair.

Prince George, B. C.
Tenders are open and will be received until August 20th by the Minister, Provincial Government Department of Public Works, for the construction of a four-room school. Plans and specifications at the offices of T. W. Herne, Government Agent, Prince George, Mr. J. Mahoney, Agent, Vancouver, and Department, Victoria. The Deputy Minister is J. E. Griffith, Victoria.

Thetford Mines, Que.
Work has been started on the school under construction by Thos. Porter, Lower Ireland, Quebec, at a cost of $4,000. The owners are The Protestant School Board, the committee being Messrs. Pharo, Lipsey, McCallum and Halmmersmith.

Toronto, Ont.
The Ramsay Contracting Company are starting the foundation work for the incinerator which is to be erected at the Don Roadway for the Board of Control. The work is under the supervision of the Street Commissioner, Mr. G. B. Wilson. The Canadian Griscour Russell Company are the general contractors.

Tenders are open and will be received until August 17th for all trades for enlarging and additions to school on Eglinton Avenue, by the Board of Education, Secretary-Treasurer, W. C. Wilkinson, City Hall. Tenders will also be received for heat regulators and sundry trades in other schools.

Winnipeg, Man.
Work is to start at once on the church at River Heights, to be of 55 x 50 frame construction, and to cost $7,800. General contractors, Grey and Davidson Company, Limited, Wall Street; architect, D. W. Bellhouse, Canada Building; pastor, Rev. A. G. Sinclair; owners, St. Andrew's Presbyterian Congregation.

CONTRACTS AWARDED

Gravenhurst, Ont.
The contract for the $35,000 Sanatorium has been awarded by the Calydor Sanatorium, Limited, to E. Webb and Son, Messessage Street E. The general contractor will do all trades, the interior

fittings and all woodwork being done by J. Orton, Front Street, Orillia. The architects are Burke, Horwood & White, 229 Yonge Street, Toronto.

Sherbrooke, Que.

The contract for the Market Building, King Street, at $7,400 has been awarded to Louis & Dakin, St. Gabriel Street. Engineer, Thomas Tremblay; Clerk, E. C. Gatien.

St. John, N. B.

The contract for Prince William Post Office fittings, awarded by the Dom. Government Department of Public Works to Rhodes Curry Company, Amherst, N. S. The estimated cost is $12,500. Tiling contract amounts to $6,000, and is let to the Italian Mosaic and Marble Tile Company, Manning Chambers, Toronto, Ont. The interior fittings are to be carried out by J. T. Schell Company, Kenyon Street, Alexandra, Ont. The architect is G. E. Fairweather, Germain Street, St. John, N. B. Secretary, Government Department, R. C. Desrochers, Ottawa.

Vancouver, B. C.

The contract for the two school buildings on Laurel and Tenth Avenue, amounting to $15,000, has been awarded by the University of British Columbia to Coffin & McLenan, 1701 Broadway W. The buildings are to be of one storey, frame construction. The architects are Sharpe & Thomson, 626 Pender Street West.

Winnipeg, Man.

The C. D. Kirk Company, of this city, have been awarded the contract for the installation of a heating and ventilating plant in the new George V. school. Architect, J. B. Mitchell, Winnipeg.

Business Buildings and Industrial Plants

Amqui, Que.

Work is to be started soon on the rebuilding, at a cost of $4,000, of the hotel in Richmond County owned by L. Pouliot, Amqui. General contractor, J. A. Brillant, Amqui.

Belleville, Ont.

Work is progressing rapidly on the store and theatre which are being erected here for the Griffin Amusement Company, Toronto. The building is scheduled for completion by October 1st. The architects are G. M. Miller and Company, Toronto, and the general contractor is George H. Holton, of Belleville.

Collingwood, Ont.

A by-law is to be submitted to the people by the Town Council on August 11th anent assisting the Bryan Manufacturing Company, of Minnesota Street, to rebuild planing mills recently destroyed by fire, the loss amounting to $80,000.

Harrow, Ont.

Andrew Brimner, of this town, is the general contractor for a bank, store and lodge hall which are to be erected here for the Oddfellows Lodge at a cost of $8,000. The architect is Thomas Jenner, of Kingsville. The building is to be of brick construction, two storeys high, with concrete block and hollow tile.

Ingersoll, Ont.

Work is to start at once on the additions to the Borden Milk Company's factory on King Street West, 121 x 45. The contract has been awarded to John Hayman & Sons, 432 Wellington Street, London.

Montreal, Que.

Work is to be started soon on the Montreal Tramways Company's vaults, Craig Street W., to cost $5,000. General contractor, W. M. Irving, 26a Stanley Street ,who is carrying out masonry, carpentry, plastering, heating, plumbing, and interior fittings. Iron and steel work by The Phoenix Bridge and Iron Works, Limited, 83 Colborne Street. Electric fittings by the owners. Tenders are now being received for painting, concrete foundation, concrete brick fireproofing and steel consturction, electric lighting, ventilating system, plastering. Architects, Hutchison, Wood & Millar, Royal Insurance Building.

Work is in progress on the alterations to L. P. Mathys' store, 141 McGill College Avenue. The approximate cost of the alterations is $4,000. The owner is doing the general contracting. His address is 333 Viger Avenue. Sub-contracts are as follows;—brick, cement, and masonry, Fleury & Verville, 1292 De St. Valier Street; carpentry, A. Kelly, 1955 St. Urbain; heating and plumbing, A. Noel, 998 Ontario Street E.; others not let.

Nanaimo, B.C.

The owners of the Bijou Theatre (National Amusement Company, Vancouver, B. C.; Managing Director, W. B. Nichols) are figuring on plans for an addition to their building here.

Orillia, Ont.

Plans are in progress for the construction of store and storage on Mississaga Street, at an approximate cost of $5,000. Work, by day labor, is to start by October 1st. The construction will be of local brick, fireproof roofing, electric lighting, stove heating, metal ceilings. The owner is T. B. Cramp, 37 Barrie Road W.

Ottawa, Ont.

The clearing of debris for the alterations to the warehouse on Slater Street is being proceeded with, the approximate cost to be $6,000. The work is being done by day labor, but contracts for heating, plumbing and electric fittings may be let later. The owners are the H. N. Bate Realty Company, Canal St. Architect, W. E. Noffke, 45 Plaza Bldg.

Owen Sound, Ont.

Work is to start at once on the curling rink, at an approximate cost of $10,000. The owners, The Grey Rink Company, Limited, will furnish the steel, the general contractors being J. C. Kennedy, 781 Second Avenue West.

Simcoe, Ont.

Excavating is being proceeded with on Kent Street for the erection of a store and bond house, at an estimated cost of $5,000. The owner is John Sutton. Architect and general contractor, M. Dillon, Port Dover, who will purchase material. To be of two storeys and basement, 25 x 80, pressed brick construction, concrete foundation, electric lighting, concrete floors, wood and metal lath, plate and prismatic glass, freight elevator, cornices, metal beams, store fronts and fixtures, sidewalk lights, screens, weather strips, water wheels.

Stowe Island, Ont.

Plans have been prepartd for a boat house, estimated to cost $6,000, for W. H. Nichols, of the General Chemical Company, New York City. Architect, F. L. Lent, Gananoque, Ont.

Victoria, B. C.

The National Amusement Company, of Vancouver, (W. B. Nichols, Managing Director) are having plans prepared for the erection of a new theatre in this city.

Wallaceburg, Ont.

A concrete business block building will be erected in the Fall, at an estimated cost of $2,000, to replace one recently destroyed by fire. The owner is Samuel Collinger.

Windsor, Ont.

Plans are in progress for alterations to store on Sandwich Street W., to consist of plate glass, 1 freight elevator and store fronts, and to cost $3,500. Owner. W. C. Kennedy, care of Gas Company. Architects, Leybourne and Sewell, Sandwich Street E.

The walls have been started on the store and flats on Wyandotte Street. The owner is W. K. Kaplan, Wyandotte St.; architect, J. C. Pennington, Labelle Building. The building, under general contractor S. Berch, 33 Parent Avenue. to consist of two storeys, 70 x 35, brick construction and foundation. Contractor will do most of work except some by day labor.

Winnipeg, Man.

Interior work has started on the store and office building which are being erected on Portage Avenue, for D. S. Curry, at a cost of $225,000. J. D. Atchison and Company of this city are the architects and the Sutherland Construction Company, Limited, the contractors.

The walls are up of the stores under construction on Corydon and Lilac Streets, by Fraser & McDonald, 512 Gertrude Avenue, for W. & J. McBain. The estimated cost of erection is $7,000. Architect, G. G. Teeter, 401 Donalda Building. The general contractor is doing the masonry, carpentry and plastering. Other contracts are as follows:—roofing, Christie Brothers, 521 Henry Avenue; painting, F. Ball, 173 Sherbrooke Street; heating and plumbing, Bearirston Plumbing Company, Limited, Fort Street; electric fittings, McDonald & Willson Lighting Company, Fort St.

Residences

Berlin, Ont.

Dr. L. A. Alvin Koeppel, 59 King E., is considering the erection of an apartment building on Frederick Street. The rough plans call for 16 apartments of 5 rooms each.

Blenheim, Ont.

Plans are in progress for a $3,500 residence to be erected by E. L. Wedge on Chatham Street. The construction will consist of frame and Milton pressed brick, stone and concrete foundation, shingle roofing, electric lighting, concrete, maple and pine floors, lime and sand plastering.

Chatham, Ont.

Excavating is going on for the erection of a $3,300 residence on Cross St. by W. T. Campbell, 71 Raleigh Street. Architect and general contractor, Frank Sparks, Sands Street. To be of 2 storeys, 28 x 30, concrete foundation, brick veneer construction, shingle roofing, electric lighting, steam heating, maple floors.

Dalrymple, Ont.

The foundations of the $7,000 residence to be built by Geo. Ivory, Dalrymple, are in. The house will be of local brick veneer construction, stone foundation, shingle roofing, hot air heating, hard wall plastering. Architect and general contractor, N. E. Plews, Orillia.

Hamilton, Ont.

Plans have been prepared for a residence on Carrick Avenue, estimated to cost $3,000. The owner and general contractor is J. H. Honeyford. The house is to be two and a half storeys high, of brick construction.

Halifax, N. S.

The residence owned by E. A. Wood, care Wood Brothers, Limited, Granville Street, has now been rooted, and consists of 2½ storeys, 40 x 45. The architect is A. R. Cobb, Cragg Building, Barrington Street. General contractor, G. H. Wright, address care E. A. Wood. Masonry, roofing and plastering by general contractor. Painting by Harrison Brothers, 56 Barrington Street. Heating, plumbing and electric fittings, Longard Brothers, 213 Hollis Street. Interior fittings are being installed by the owner.

Keady, Ont.

Albert Hall, 9th Concession, Keady, Owen Sound, contemplates the erection of a $3,000 residence to replace the one destroyed by fire. Construction to be of brick.

London, Ont.

Excavating is going on for the erection of a $4,500 residence on Richmond Street. Owner, Miss J. Lashbrook, Richmond Street. Architects, McBride & Gilbert, Edge Block; general contractor, J. A. Stanley, 1053 Richmond Street, who will do most of the work and sublet some. To be two storeys, 25 x 32, concrete foundation, solid brick construction.

Montreal, Que.

The roofing has been started on the nine flats, under construction by Pascal Latreille, 3597 St. Hubert Street, at a cost of $5,000. The work is being done by day labor, electric fittings by Ovila Beaulieu, 2435 St. Urbain Street. To be two storeys, 7 x 32.

Plastering of the 2 double residences on Oxford Street being erected by Arthur Cloutier, 810 Durocher Street, Outremont, is now being proceeded with. Contracts are as follows: Roofing, Jos. Lamarche, 896 Drolet Street; plastering, owner; painting, O. Perras, 1162 Henri Julien Avenue; heating and plumbing, Mr. Laberge, care owner; electric fittings, G. Martel, 229 Bernard Street. The residences will cost $13,000, and will consist of 2 storeys, 31 x 37; brick construction.

The foundations of the two residences to be erected on Marlowe Street, near Cote Street and Antoine Road, by G. C. Anglins, Limited, 65 Victoria Street, are now in. They will consist of 2 storeys, 24 x 42, concrete foundation, terra-cotta construction, felt and gravel roofing, hot water heating. Estimated cost $10,000.

Napanee, Ont.

Excavating for the erection of Judge J. Madden's $6,000 residence has commenced, the work being done by day labor under supervision of architect, A. Stuart Allaster, 42 King Street E., Brockville. Building to consist of 2 storeys, 30 x 40; pressed brick, shingle roofing, hard wall plastering, mosaic tiling.

Ottawa, Ont.

Excavating has been completed in connection with the alterations to the residence on Wilbrod Street, owned by J. A. D. Holbrook, 25 Cliff Street. General contractor, S. F. Smith, 449 McLeod Street. To be 26 x 31, solid brick construction. Heating and plumbing, R. Murphy, 411 Lisgar Street. Most of the other work is being done by the general contractor. Architect, J. Albert Ewart, Booth Building, Sparks Street.

The walls of the $5,000 residence on Bellwood Street, owned by the Oakland Land Company (address W. J. Spratt, Sunnyside Avenue), are up. To be of brick veneer construction. Contracts as follows:—carpentry, W. Fryer, 5 Glen Avenue; heating and plumbing, J. P. Band, 775 Bank Street; electric fittings, Dominion Electric Company, 417 Sparks Street.

Good progress has been made on the alterations to the apartment house which is being erected on Somerset Street by C. D. Joyce. The owner, Mr. Joyce, is in the market for interior fittings.

The roofing has been reached of the $20,000 apartments under construction by Chas. Holbrook & Son, 425 Somerset Street. They are to be of brick veneer. Plastering by Broo9ks and Davis; painting, owners; electric fittings, W. R. McCallum, 525 Bank Street.

The foundations have been started of the three residences on Melrose Street to be built by Foster and Marks, 11 Irving Avenue, at a cost of $5,000. To be of brick veneer, stone foundation. Plastering by W. Lethbridge, care Foster & Marks; heating, James Phillips, 1005 Wellington Street; plumbing, H. Lethbridge, 1st Avenue; electric fittings, Dominion Electric Company, 417 Sparks Street.

The roofing has been reached of the $5,500 residence on Woodlawn Street under construction by Cuthbert & Clark, 143 Hawthorne Street, for E. G. Brown, Hope Chambers. Work consists of stucco and brick veneer construction. Heating and plumbing by Thomas Watters, 288 Booth Street.

Port Elgin, Ont.

The construction of two residences at $1,500 each is contemplated by D. J. Izzard. They will consist of white brick construction, stone foundation, shingle roofing, hot air heating, electric lighting, pine floors. The old buildings now on the lot will be torn down and rough lumber used on new houses. Owner will purchase sash, doors, and trimmings. Work done by day labor, to start this month.

A. J. Vanderlick contemplates the erection of two residences at $1,500 each. They will consist of white brick construction, shingle roofing, hot air heating, electric lighting, pine floors. The owner will probably build this Fall by day labor.

Preston, Ont.

Excavating is being proceeded with for the construction of a $3,200 residence by Bernhardt & Spalding, King Street. General contractors, Kinzel & Sons. To consist of concrete block construction, concrete foundation, shingle roofing, electric lighting, maple, pine and concrete floors.

Quebec, Que.

The foundations are in for a $3,000 frame and brick residence to be erected on St. Luc Street by F. X. Turcotte.

The foundations are in for a $5,000 residence on Second Avenue, Stadacona, for J. J. Cameron. The general contractor is J. Bornais, of Limoilou. The building is to be three storeys high, of brick construction.

Excavating is in progress for a $5,000 house on Bourlamarque Avenue for Arthur Frenettte, who will put up the building himself. The house is to be three storeys high, of brick construction.

Excavating is being proceeded with for the erection, at an estimated cost of $5,000, of a residence on Charlesbourg Road by Esdras Lavoie, 288 Third Ave., Limoilou. Work by day labor. To consist of 3 storeys, 35 x 30; concrete foundation, frame and brick construction; tin and asbestos roofing; hot water heating.

Excavating is going on for the $3,000 residence to be erected on Sixth Street, between Second and Third Avenue, Limoilou, by Gab. Hamel, Third Avenue, the work being done by day labor. To consist of 2 storeys, 25 x 32, concrete foundation, brick construction, tin and asbestos roofing, electric lighting, stove heating.

Toronto, Ont.

A. Woolrich is to put up a pair of two and a half storey brick houses on Awde Street, at a cost of $7,500, and will let the smaller trades.

W. Williams has commenced the erection of two two-storey, brick, detached residences on Morrison Avenue, and will sublet the smaller trades.

The foundations of the detached residence, to be erected by R. J. Cole, 15 Northcliffe Boulevard, are in. The owner superintends construction and lets to smaller trades. To be of two storeys, 22 x 40, brick construction, shingle roofing, electric lighting, hot air heating, birch and spruce floors, mantels.

The walls are going up of the pair of residences being erected on Ellsworth Avenue (156-8) by Purton & Chennel, 634 Christie Street, at a cost of $4,500. The owners are letting smaller trades. Structures to consist of 2 storeys, 34 x 42; brick construction; gas lighting; hot air heating; birch and spruce floors.

T. J. Allen, 48 Oakmont Road, is erecting a pair of residences on Boon Ave., at a cost of $3,600, the work having now reached the stage of flooring. They are to consist of 2 storeys, 34 x 42; brick construction. Plumbing is by G. Hamilton & Company, 494 Dundas Street. Owner is still receiving tenders for other trades.

Excavating is going on for a detached residence to be erected on Lauder Ave. by W. Edmonds, 16 Biggar Avenue, at a cost of $5,000, to consist of 2½ storeys, 24 x 34, brick construction, hot water heating. The owner will let smaller trades.

Plans are drawn and tenders open for the erection of a pair of residences on Hope Street at a cost of $5,000. Owner and general contractor, who is also doing the carpentry and plumbing, C. A. Drew, 119 Nairn Street. Tenders are wanted on all other trades. Buildings to consist of 2 storeys, brick construction, hot air heating, gas and electric lighting, lime and sand plastering, mantels. Work has not yet been started.

Excavating is going on for the erection of a $3,000 residence on Mount Royal Avenue by Robert Stevenson, 627 Indian Road, who will sub-let smaller trades. To be of 2½ stores, brick construction, hot water heating, shingle soofing, electric lighting, lime and sand plastering.

Excavating is being proceeded with on Thorne Crescent, for the erection of a residence by J. Edmonds, 71 Oakwood Avenue, to cost $4,000 and to be of 2½ storeys, brick construction, hot water heating, gas and electric lighting, shingle roofing. Owner will sub-let smaller trades.

Work is to be commenced at once on the two detached residences to be erected by L. Bailey, owner, in trust, 30 Glenholme Avenue, who will sub let to smaller trades. They are to consist of two storeys, 20 x 42, brick construction and foundation, shingle roofing, hot water heating, electric and gas lighting.

Winnipeg, Man.

The $4,500 residence, under construction by R. C. Mitchell, 312 Florence Avenue, has now been roofed. Plumbing and heating are being done by C. C. Young Company, Limited, 1650 McDermot Avenue; electrical fittings, N. MacDonald, 280 Bartlett Avenue; painting by the general contractor.

Work is in progress on the $3,500 residence under erection on Rathgar St., between Nassau and John Streets, by W. Parker, 473 Beresford Avenue. The building is to be of two storeys, 24 x 38, stone foundation, frame construction, electric lighting, shingle roofing, hot water heating.

CONTRACTS AWARDED.

London, Ont.

The following contracts have been awarded in connection with the $6,000 residence which W. D. Thomas is erecting on William Street according to plans prepared by J. V. Munro, architect, of this city:—plastering, A. Dowell; painting and glazing, George Burdick; roofing, J. Whittaker; heating and plumbing, L. J. O'Dell—all of Toronto.

Ottawa, Ont.

The contract for the alterations and additions to the residence on Wilbrod Street of J. A. Holbrook, 25 Cliff Street, at a cost of $7,000, has been awarded to S. F. Smith, 448 McLeod Street. Architect, J. Albert Ewart, Booth Building, Sparks Street. The work consists of concrete block and brick construction, stone foundation, tar and gravel roofing, hot water heating, electric lighting.

Toronto, Ont.

In connection with the residence being erected on Neville Park Boulevard by J. T. Moore, 30 Brookmount Road, the following contracts have been let:—plumbing, Duffart Bros., 862 Kingston Road; heating, Pease Foundry Company, 118 King Street E.; plastering, E. Buridge, 395 Woodbine Avenue; painting, G. Over, 299 Woodbine Avenue; electrical work, A. Partridge, 11 Wayland Avenue.

The contract for plumbing and heating at the residence built on Pine Crescent for W. M. Miskelly, 174 Victor Avenue, has been let to James Fiddis, 60 Wineva Avenue, the contract for electrical work to Dawson & Palmer, 276 Waverley Road, and for plastering to S. J. Bailey, 73 Bedford Park Avenue.

J. M. Heale, 61 Oakmount Road, has let the contract for plastering a residence erected on Indian Road to James Robertson, 615 Lansdowne Avenue.

In connection with the residence erected at 56 Indian Grove, for Morden Neilson, 311 Gladstone Ave., the contract for electrical work has been let to W. B. Gibson, 27 Colborne Street, and for concrete work to the Ramsay Construction Compay, 37 Indian Road Crescent.

The general, carpentry and masonry contracts for the erection of an addition to the residence at Wrentham Place and Roxborough Street E. for R. A. Beggs, Confederation Life Building, have been let to W. A. Nixon, 146 Ossington Avenue. Approximate cost, $6,000. Brick construction, shingle roofing.

In connection with the residence and garage in course of erection on Connaught Avenue, York Township, for E. B. Varey, 142 Melgund Road, the carpentry contract has been awarded to P. A. Schwalm, 469 Shaw Street, the contract for heating and plumbing to Robert Ross, 1349 Queen Street W., and for electrical work to Edwards & Coley, 655 Dupont Street.

The contract for plastering the residence erected at 34 Bracondale Hill Road for W. Murray, 72 Forest Hill Road, has been let to H. G. Finbow, 496 Manning Avenue,

In connection with the residence built on Wightman Avenue by Playter & Chapman, 176 Danforth Avenue, the contract for plastering has been let to C. W. Baldwin, 1026 Gerrard Street East.

In connection with the residence built at 96 Balsam Avenue by George M. Martin, 100 Wood Street, the heating, plumbing and electrical contract has been let to Hillier & Company, 2199 Queen Street E., and the plastering contract to White Bros., 55 Hunter Street. Painting not let.

The general contract for the erection of a pair of residences at 29 Auburn Avenue for Miss E. Dickens, 101 Gloucester Street, has been let to J. J. Leggatt, 82 Auburn Avenue. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,500.

Westmount, Que.

The following contracts have been let in connection with the residence built on Edgehill Avenue for C. W. Tinling, 456 MacKay Street:—masonry, carpentry and plastering, A. K. Hutchison, New Birks Building; tiling, James Walker Hardware Company, Limited, 253 St. James Street; roofing, Richardson, Simard & Company, 745 Clarke Street; heating and plumbing, J. Campbell, 456 Guy Street; electrical work, Vincent & Say Electric Company, 25 Union Avenue.

The contract for electrical work at the residence built at Redfern and Westmount Avenues by J. Quinlan, 4412 St. Catherine Street, Montreal, has been let to McDonald & Wilson Company, Limited, 99 Drummond Street.

Wiarton, Ont.

Work has been commenced on the erection of a rectory in connection with Trinity Church. The masonry contract has been let to F. Robertson and the carpentry contract to G. Hurbut. Approximate cost, $3,500. A quantity of stone is required.

Power Plants, Electricity and Telephones

Beverly Township, Ont.

The ratepayers have approved a by-law to raise $4,500 for the installation of the hydro-electric system. W. Wood, of Rocton, is Clerk to the Township Council.

Govan, Sask.

The Scandinavian Rural Telephone Company, Limited, have let the contract for the construction of their system to Brown & McKenzie, Regina, at $3,400. Equipment has been purchased.

Guelph, Ont.

The walls of the $22,000 telephone building on Cork Street are up. The building is under the construction of the general contractors, P. H. Secord and Sons, Limited, 133 Nelson Street, for the Bell Telephone Company (head office, Montreal), and will be of two storeys, 33 x 52. Galvanized iron and roofing by Turnbull & Cutcliffe, care general contracttor.

Listowel, Ont.

Vote is to be taken on August 21st on a by-law authorizing the installation of hydro-electric system at a cost of $6,600. Town Clerk, Wm. Bright.

Milverton, Ont.

A by-law was submitted by the Town Council and carried on July 30th, for the installation of Hydro-Electric System. Town Clerk, W. D. Weir.

Mount Forest, Sask.

An extension of the telephone system, to cost $11,000, is contemplated by the Mount Forest Rural Telephone Company (Secretary, I. A. Monsees). The line is to be approximately 40 miles long, 88 circuit miles of wire connecting Mefort, Mount Forest, Bagley and Brockington.

Palmerston, Ont.

A by-law has been carried to introduce the hydro-electric system. Town Clerk, H. Hyndman.

Southampton, Ont.

A by-law providing for the installation of a hydro-electric system at an approximate cost of $13,000 will be submitted shortly. Town Clerk, J. C. Eskford.

St. Hilaire, Que.

Tenders are open and will be received by the Municipal Council up to 6 p.m., August 23rd, for the construction of an electric lighting system. Plans and specifications are with the Secretary-Treasurer, J. E. M. Desrochers.

CONTRACTS AWARDED

Beaverdale, Sask.

In connection with the telephone system, owned by the Creekside Rural

Telephone Company, Limited (Sec-y.-Treasurer, A. L. Ashdown), the contract has been awarded to Houston Tallman Company, Regina, at a cost of $4,952. The contractor will purchase material.

Winnipeg, Man.
The following contracts have been awarded in connection with the telephone building which is being erected here by the Bell Telephone Company at a cost of $45,000:—roofing, G. W. Reed & Company, Montreal; architectural ironwork, John Watson & Son, Montreal. The architect for the building is W. J. Carmichael, Montreal, and the general contractors are Anglins, Limited, Montreal.

Fires

Bridgeburg, Ont.
The barn owned by Jonas Sherk, of this town, was destroyed by fire last week, at a loss of $4,000.

Burlington, Ont.
The store owned by Taylor Brothers, of this town, was destroyed by fire last week, at a loss of $4,000.

Bury, Que.
L. H. Martin's sawmill has been destroyed by fire, with a loss of $8,000. Owner will rebuild. Machinery will be required.

Centreville, Ont.
A barn belonging to Alonzo Johnston has been totally destroyed by fire. Loss partly covered by insurance.

Fredericton, N. B.
A. E. Kilburn's residence and barn on the Woodstock Road have been completely destroyed by fire. Loss, $5,000.

Glace Basy, N. S.
The residence and store of Morris Silber, Reserve Street, has been burnt down and totally destroyed, the loss amounting to $2,500.

Gravenhurst, Ont.
The boat-building plant of H. Ditchburn & Company, Muskoka Wharf, has been partially destroyed by fire.

Hartland, N. B. (near)
A residence owned by Isaac Morehouse has been totally destroyed by fire.

Junetown, Ont.
Fire has destroyed the residence of J. A. Herbison. Loss, $3,000, partially insured.

Knowlton, Que.
Fire has destroyed the Y. M. C. A. Building, causing loss to the extent of $2,300. Matron, Miss Strathy.

L'Assomption, Que.
A carriage factory owned by T. Bedard Company was destroyed by fire, at a loss of $8,000. The owner will rebuild and require machinery.

Leamington, Ont.
A residence and barn belonging to A. E. Reach, Concession C., have been destroyed by fire. Loss $3,000.

Mitchell, Ont.
W. G. Wills' theatre has been totally destroyed by fire.

Norland, Ont.
Fire has totally destroyed James Bryant's sawmill.

North Bay, Ont.
The Gordon Lumber Company, Gache Bay, have suffered the loss of their saw mill, the destruction by fire amounting to a loss of $150,000, which is covered by insurance to the extent of $75,000.

Oneida Township, Ont.
Fire has destroyed a barn belonging to E. Herod, Caledonia. Loss, $3,000, insurance $2,000. Owner will build a barn of steel construction.

Ottawa, Ont.
Stables, owned by the Ottawa Transfer Company, Lisgar Street, have been damaged by fire. The loss, $3,000, is covered by insurance.

Ponoka, Alta.
The flour mill belonging to Alexander & Tugman has been destroyed by fire. Loss $5,000.

Port Moody, B.C.
The residence owned by Mr. James Latta, George Street, has been completely destroyed by fire. Partly insured.

Rosedale, B. C.
A shingle mill owned by Messrs. Lang & Rodd was damaged by fire, the loss amounting to $4,000.

St. Gerard Magella, Que.
Jean Carreau's residence and stable have been gutted by fire, with a loss of $5,000.

St. Johns, Que.
Mr. C. Pontre has had his barn and stables totally destroyed by fire, the loss amounting to $4,000. Partly insured.

Sudbury, Ont.
Fire has destroyed two residences and a barn on Station Street, belonging to Peter Taylor and Marko Genaro.

Warren, Ont.
A business block and a number of residences have been destroyed by fire. Approximate loss, $100,000. Owners, E. Langlois, residence; D. Laporte, hotel; S. Soufrine, store; M. J. Dubeau, post office; M. Burke, store; H. H. Roy, store and residence; A. Parisen, residence; Mrs. Chartier, residence; A. E. Parteishck, residence; Boyd & Roy, machinery shed and office.

Welland, Ont.
Fire has destroyed four residences on Second Street, the property of William Mitchell, Aqueduct Street. Loss, $5,000, partially insured.

Mr. Samuel L. Lambert suffered the loss of his roller rink on Dennistoun Street, totally destroyed by fire at a loss of $5,000. Insurance covers the damage to an extent of $3,000. It is expected that the rink will be rebuilt.

Westmount, Que.
The residence 1160-8 Selby Street, part owned by Mr. H. J. Ross, 180 St. James Street, Montreal, has been destroyed by fire. Repairs will be made shortly. The loss is to the extent of $4,000.

Miscellaneous

Clinton, Ont.
Byam & Sutter are receiving prices on fireproof roofing and Brantford artificial green roofing tile.

London, Ont.
J. Yokum, care of Hyman's Tannery, will be in the market shortly for all equipment necessary for the manufacture of oils and tanning fluids.

Moncton, N. B.
Prices on a planer, with calking knives, and on a 75-ton engine, standard gauge, are being received by E. R. Reid, Manager of the Minto Hotel.

A. R. C. Clarke & Son, 51 Water Street, are receiving prices on a trencher and small steam shovel for water and sewerage work.

Montreal, Que.
S. & A. Brochu, 294 St. Catherine St. E., are receiving prices and other information with respect to brick, cement, concrete mixers, glass, lumber, skylights, wood and graphite paint, plumbing fixtures and woodworking machinery.

Ottawa, Ont.
The Department of Marine & Fisheries, Ottawa, will receive tenders until August 16th for the construction of a wooden lighthouse on concrete piers at McQuestion Point, Renfrew County. Plans at office of the Department, and at the Post Offices, Pembroke, Arnprior, Renfrew, and Fort William, Pontiac County, Que.

Sandstone, Alta.
The Southern Alberta Refineries, Limited, Lougheed Building, Calgary, are receiving prices on machinery necessary for oil refining.

Trois Pistoles, Que.
J. H. Morine et Fils are receiving prices and other information with regard to cement, steel, metal lath, screens, seating, hot water boilers, hot air furnaces, pine and bass lumber, metal shutters and woodworking machinery.

Winnipeg, Man.
Josie & McLeod, 49 Gertie Street, are receiving prices and catalogues on hot water boilers, black, galvanized and cast iron pipes, ½-inch to 4-inch, hydraulic pumps, cast and galvanized iron fittings, radiation and valves.

Market for Machinery in Switzerland

Perhaps never before in the history of Switzerland has there existed such promise for independent commercial progress as at present. The state of war, involving the principal nations of Europe, is responsible for much optimism in that country.

Many Swiss firms which have been dependent upon European representatives in surrounding countries for products coming from the Orient, England, and America, now look forward to independence when seeking to supply their own demands through importation. They believe that the time has arrived when it will be mutually advantageous for American manufacturers and exporters and Swiss buyers to establish direct connections.

Increasing demands are now being made upon foreign representatives in Switzerland for American goods, and indications are that they will continue to grow. One importer of American machines and machine tools states that his firm is receiving many substantial orders for American products, whereas goods manufactured on the continent of Europe were formerly in demand. He believes that during the war and for some time afterwards orders will be placed in Switzerland for machinery and tools which have previously been given direct to factories in surrounding countries.

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Civic Stock-Taking

IN most commercial undertakings it is necessary to take stock at least once a year, and in all concerns it is essential that this should be done as frequently as possible. This condition applies with equal force to civic matters—for, after all, the business of a city should be conducted like a large commercial undertaking.

When times are prosperous and money is fairly plentiful, there is a tendency to cast aside considerations of conservative progress. There is an impatience for rapid development, and the person who advocates more investigation into civic affairs when business is brisk is apt to be thought something akin to a knocker.

Now, however, with a serious check in the expenditure of money on new works, owing to the war and the depression, it is worth while thinking over civic problems and striking a balance sheet to show how the city stands—financially, ethically, and otherwise. This is the time for mature consideration of the needs of a city, and how best to attain them. This is the time, also, for engineers to investigate thoroughly problems of pure water supply, efficient sewage treatment, economical construction of roads and streets, satisfactory disposal of refuse, and so on. When the engineers are busy there is little time for study and investigation, or for comparing the results obtained in their cities with others. But in periods like the present an excellent opportunity is afforded for inquiries and comparisons.

It is by judicious correlation of data bearing on any branch of work that a reliable judgment as to the value received can be arrived at. If such comparisons and studies are not made the authorities may continue to perform their duties with an agreeable complacency to themselves, although others may observe the lack of efficiency and economy.

When Aldermen take a personal and intelligent interest in the affairs of a city, and devote as much time as possible to the study of the problems which have to be encountered, then the Engineer's labors also will be appreciated. And the Engineer in most instances will welcome the individual consideration of Aldermen, as it tends to unite them in their combined efforts to serve the citizens. It is the spasmodic and erratic manifestation of peculiar interest on the part of some Aldermen that disconcerts the officials, and often takes the heart out of them. The business of city administration cannot be learned by simply getting elected, or by casual inquiries; it needs persistent study, for each day brings new requirements, and each event produces new developments.

After a period of strenuous growth and great prosperity, our cities will do well to utilize the present quiet time to take stock of what has been done, and what is required to be done. It is well that the ratepayers should have a clear conception of what they own, what changes have been wrought in the last few years, and generally to know what the authorities and their officials have done on their behalf. And having established a firm grip of the situation, with its possibilities and duties, then those who have labored faithfully and well in the interests and welfare of the citizens should be encouraged to continue in their good work.

It is often found, when stock-taking, that some deadwood has accumulated—that some parts of a machine are not maintained as carefully as others, or that some department has conducted its business with efficiency and great economy. The weakness and lack of co-ordination of some branches will be discovered, and the power of others will shine out. But it is often at stock-taking that these conditions are established.

The Municipal Engineer who takes pride in his profession and the achievements of his department has nothing to conceal. Stock-taking to him will be a source of pleasure and satisfaction, for he knows that when properly conducted it will reveal many things that should be known—as that the water-works are maintained in excellent condition, and the cost, both capital and ordinary, is kept low; that the sewage treatment works are operated with care and intelligence, producing an effluent of satisfactory quality; and that the streets and roads are not more holey than good, but are kept in excellent condition, adding materially to the aesthetical side of the city.

Municipal works can be operated as economically as any other works—provided, of course, the officials are given a free hand to do their best.

Tunnel Construction in Flood Time

Specially contributed by Paul Seurot, Consulting Engineer, Montreal

It is the writer's intention in this article to show how a subaqueous tunnel under construction is comparatively immune from the dangers attending an unusual flood. Floods within a subaqueous tunnel are not unusual happenings. They are one of the necessary evils of this type of construction and are ordinarily the result of a "blow," i.e., a sudden escape of compressed air through the face and the river bed, with a consequent inrush of water through the shield and into the heading. In the particular instance discussed in this article, however, the tunnel was flooded by water coming, at the rear, through the shaft and the approaches.

In the distance there may be seen the travelling crane over Shaft A under water. The building to the left is occupied by the various departments of the Foreign Office. When compressed air blew out a water spout was thrown on the roof of this building.

The tunnel under construction, known as the Invalides-Concorde Tunnel, was a section of the Paris Metropolitan Subway, passing under the Seine, between the Concorde and Alexander Bridges. Its length, including approaches, was 2,743 feet. It was circular in section, 25 ft. 6 in. in diameter, and the gradient of the approaches was five per cent. Work had been prosecuted from two shafts, A and B, on the left and right banks of the river respectively.

About January 10th, 1910, the Seine began to rise slowly, but there was nothing unusual about it. From all over the country, however, there were reports of continued rains which had so saturated the ground that there was a fear of heavy floods.

On the 20th of January, the water level had risen from datum 27.10 to elevation 30.00, 9 ft. 6 ins. above normal. The intersection of the streets back of the plant and shaft A is 820 ft. from the water edge when at the normal level, and its elevation is 30.846, or, in normal conditions, 12 ft. 3½ ins. above datum. The shaft itself was 689 feet from the water edge and its curb at about the same level, 12 ft. 3½ ins. above river datum. On January 22nd the river rose to elevation 31.50, 25¾ ins. above the street and shaft level, and the water began to back up through the sewer manholes and invade the streets and the works yards. Men were set to work building dams across the streets and around the site of the plant to save the works.

On the right bank of the river, the heading had already been invaded through the Nord-Sud Company's tunnels. This company, which now operates the Nord-Sud Railway, was flooded through the bursting of a large trunk sewer. The water poured in their works for a distance of 2¼ miles. Near the Madeleine, this company's tunnels pass over the line No. 8, of which the Invalide-Concorde tunnel is a portion. From the Madeleine overhead crossing, the water poured in the works of line No. 8 and came down towards shaft B until it reached the level of the river. Gangs of men had been set to work erecting dams in the tunnels between the Concorde and the Madeleine, but the difference of levels was such that in order to stem the invading torrents it would have been necessary to wall up the tunnels entirely, and there was no time for it. In the compressed air, the heading had been pushed well under the river bed, and work was going on without any trouble. However, as the water was still rising and threatened every minute to flow from the streets into the shaft, it was deemed prudent to get the men out of the heading, as they might be trapped in. Before leaving the heading, however, it was thoroughly grouted up. It was the intention, if the compressor plant did not fail, to keep the pressure in the tube and save the heading.

Meanwhile the water kept rising rapidly. At the Pont Mirabeau, where line No. 8 crosses the Seine a second time, and where the work was being executed by caissons, the plant was under water, and the intervening two and a half miles of finished or partly finished tunnels were threatened by the inundation. Part of them was already flooded, and men were busy erecting dams along the line—particularly at the high point of the profile between the two subaqueous tunnels.

On January 26th, the water level was 33.02, or 7 ft. 1¼ in. above the level of the street and of the works' site. Most of the pumps, dynamos, and other machinery had been hoisted up and removed to places of safety. The dams surrounding the shaft and part of the plant were still holding. Down in the tunnel, some of the dams erected about a mile up had been partly carried away and the water was beginning to flow in the masonry approach.

On the right bank, the troops had built earthen dams on the Place de la Concorde to protect the rue Royale, and with sand bags had raised the parapet wall, above the top of which the water had already risen; but it was useless as far as shaft B and the work on that side of the river were concerned. The water, stemmed a while on the river side, came from the sewers and through the Metropolitan tunnels. The Champs-Elysees was transformed into a huge lake, and the entire works were flooded.

On the other side the compressors were still working and the heading was safe. Water was beginning to invade the lower part of the Invalides Station of the Western Railway adjoining the plant. For more than three miles, this railway follows the shore of the river in a deep cut. Early on January 26th this cut was flooded and in the afternoon the water backing up to the station burst in the street and flooded the tunnel site, carrying all dams and protective works. Three compressors were running and the pressure was maintained so as to equilibrate the hydrostatic pressure at the face, but the pressure of the water above the sills of the lock doors on the normal air side as the danger now was that this pressure would tend to burst open the doors and invade the heading. Orders were given to raise the air pressure as the level of the water would rise. At 2 a.m. on January 27th the water level came up to elevation 33.20; a fourth compressor was set to work and the pressure kept at two atmospheres. At 3 a.m. the electric current gave out. One of the two electric plants supplying the power had had its cables broken or short circuited through the flooded ducts in the streets and the other plant was submerged.

The tunnel when the water level had been lowered sufficiently to permit of salvage work.

Through the ever-increasing head of water, no longer checked by the air pressure, the lock doors probably opened. At that instant, and with a loud report, the air burst out and through the open shaft hurled a column of water, as a spout, 60 feet in the air, onto the roof of the Foreign Office building fronting on the other side of the street—shown in one of the illustrations. The pressure fell rapidly from 3.30 a.m. until 5 a.m., when the recording gauge showed a pressure of 1.5 lbs. At 8 a.m. it had fallen to zero.

The next day the water level reached its maximum at elevation 33.50, which is 21 feet above the normal river datum and 8 ft. 8½ ins. above the street level at the works' site and above the top of shaft A.

On January 31st the water began to recede slowly from the Esplanade and streets surrounding the works. On February 10 one of the electric plants was able to make some temporary connection and to furnish some power. Pumps were set to work, but it was done slowly and cautiously, so as not to overtax the capacity of the sewers into which the flood water from the cellars, basements and tunnels of the entire district was being emptied.

In the present case, the tunnel being the lowest point on the profile for a mile and a half in both directions, it came to the lot of the contractors to pump the water from their work as well as from adjoining sections. Of course, all of this was done at the expense of the city, a special appropriation being set aside to cover this extra work, as well as to indemnify the contractors for all just and proved losses due to the inundation.

Another serious problem was facing Paris and a great part of the country—a shortage of pumps.

All available pumps were requisitioned by the army and by the public services, and were bought or hired by the Metropolitan Railway, by other railway companies and private industries and citizens. All sorts of antiquated hand or steam pumps could be seen everywhere in the streets.

At the tunnel works, two of the big pumps had been left in the shaft. On the left bank two centrifugal pumps, one 8-inch and one 6-inch, were available with two 30 h.p. motors, and were set to work. To these were added, a few days later, two 4-inch centrifugal pumps. On the right shore all the pumps but one—an 8-inch pump—had been removed through shaft B and were put to work, emptying directly into the river. There were two 7-inch, one 6-inch, one 5-inch and one 3-inch—all centrifugal pumps. On this side of the river, the Nord-Sud Company, the Metropolitan Railway and other concerns were all doing their share of the salvage work, and on February 28th the water level had gone down sufficiently to resume work.

On the other shore the water had gone down to the bottom of the shaft and on March 8th had subsided to elevation 16.50, which is about 2 feet lower than the top of the material lock. Pumping was continued until the water was low enough to allow the doors of both material and men's locks to be cleaned and closed. The water level was then down to 15.00, which was about the level of the centre of the shield.

Air pressure was turned on on March 15. After cleaning the heading and the shield, work was resumed on the 22nd. There was no injury whatever to the tube or machinery. Only about 15 cubic yards of sand had caved in at the face. The packings of the rams and all the leather cups of the erectors had to be renewed, of course, and all the iron lining was cleaned with water under pressure, scrubbed from slime and the entire works disinfected.

A movement to secure the passage of a uniform state building law is now being carried on in Massachusetts. A special committee of the Boston Chamber of Commerce has appointed a sub-committee with Mr. C. H. Blackall, a Boston architect, acting as chairman, the purpose of this committee being to gather data and direct the chamber's attitude toward a bill now pending in the Legislature.

Are Refuse Incinerator Guarantees too Strict for Practical Fulfilment?

In which Mr. Sterling H. Bunnel, of The Griscom-Russell Company, New York, discusses refuse incinerator progress in the United States, and calls attention to the importance of good firing and the inadequacy of mere machinery to produce results. Attention is directed, also, to the letter dealing with this subject written by Mr. F. L. Decarie, of Montreal, published on page 867 of this issue.

A recent article in the Engineering Record reviews the development of refuse incineration in high temperature destructors, and puts forth the suggestion that the requirements of specifications have been too difficult for practical fulfilment. Refuse destructor plants are actually in successful and satisfactory operation in very many European cities. Requirements in European cities are generally more exacting than in American cities, so that it seems strange that there should be any difficulty in satisfying American city officials by the operation of destructor plants built in accordance with the best Europeon practice.

All engineers are familiar with the fact that the interpretation of specifications on rigid lines is often the cause of unfair requirements, and has more than once led to the rejection of plants which were in every way satisfactory except in some non-essential technical point. On the other hand, service boards and engineers have not the discretion permitted to the commercial corporation or private citizen, in insisting that the apparatus under contract shall be made broadly satisfactory. Being restricted in action by laws, the city official can hardly secure correction of defects unless such defects amount to a definite breach of guarantee. Not infrequently, therefore, the apparently unfair severity of interpretation of contract requirements is the only means of forcibly expressing dissatisfaction because of other and really serious faults not covered by the terms of the written guarantee.

The standard guarantees for destructor plant operation are not at all difficult for well designed furnaces to attain. They are generally:—

1. That no nuisance be created during the ordinary operation of the plant.

2. That no odors, obnoxious gases, smoke or dust escape from the chimney.

3. That the temperature in the combustion chamber shall not fall below 1250 degrees Fahr.

4. That the residue from the fires shall be hard, thoroughly burned clinker, free from organic matter.

5. That the weight of combustion per square foot of grate, the weight of evaporation per pound of refuse burned, and the labor cost per ton of refuse burned be within guaranteed limits.

The first two, while apparently difficult, are in reality easy of fulfilment. The collection and movement of garbage and refuse is in itself a disagreeable necessity, and a destructor plant can hardly be claimed to create a nuisance that already exists. Chimneys of destructors are usually not less than 125 feet high, and many are much higher; so that odors, gases, smoke and dust must escape in quantity to be observable at the ground level. The last three guarantee clauses depend entirely (and the first two to a large extent) upon the handling of the refuse into and through the firing process, which in the case of tests is usually in the hands of skilled men employed by the contractor. It is necessary to look outside of the working of the guarantees to find the points of general dissatisfaction which may drive the city officials to refusing acceptance on narrow technical grounds for that which will be a constant source of trouble later.

Of the scores of destruction plants in operation in cities outside of North America, the great majority have shovel-fed, hand-clinkered furnaces. In the smaller plants, the garbage and refuse is carted into the furnace room and dumped over the back of shallow bins, to be shovelled directly into the furnace doors opposite. The collected waste consists of a mixture of everything—wet, dry, combustible and unburnable together. The fireman casts out such of the stones, glass, large tins and pieces of metal as he can get at easily, and fires the rest of the mass as it comes. Naturally, the work of firing is not done when the material has landed on the gates. Refuse fires burn into holes, melt into large clinkers, and clog grates with metal fragments, and so need frequent stirring and levelling. Finally, when a mass of clinker and ash has accumulated and begins to block the draft, the fire must be thoroughly gone through and cleaned. No one familiar with the care required in firing even low grade coal would entertain the notion that a mixture of wet fuel and unburnable trash can be dumped in a heap upon grates and expected to burn to a uniform bed of ashes without frequent stoking by an experienced and watchful fireman.

Unfortunately, there has been a tendency in bidding on destructor plants for American cities to make impossible claims of low labor cost, based on the use of expensive mechanical charging and clinkering devices intended to operate without any manual labor. In this way several cities have been induced to accept the highest bid presented, and to install expensive and complicated apparatus, with the expectation of operating half a dozen high-temperature furnaces with 150 square feet of grate surface or more, at a cost per ton of refuse burned which contemplated the employment of a fire-room force totally inadequate to the situation. No amount of machinery, however ingenious, can do all the work of the competent fireman. In theory it would be possible to construct a boiler plant of enormous size, install coal handling devices and automatic stokers throughout, and run the whole plant by push buttons from a carpeted engine room at a distant point. In practice, machinery even of the rough and rugged character required in connection with boiler plant operation must be supervised and cared for; so that the most that can be hoped for is some reduction in the number of men required. With garbage fires, the variety of the materials to be burned makes impossible the uniform method of operation of the mechanical stoker system.

The bulk of the work of furnace tending, spreading the mass on the grates, filling holes in the fire bed, and clearing the fire of clinker, must always be done by hand labor.

The success of the destructor system of garbage and waste disposal depends on the ability of the firemen. The work does not require a high degree of intelligence, but does require steady, reliable service from the fire-room force. If this is clearly recognized city officials will save much in first cost of destructor plants by avoiding the inclusion of complicated apparatus intended to do what is impossible for machinery. They will thus secure furnace equipment of simple and durable construction, suitable for successful operation by the better class of common labor which is attracted by the steadiness of city employment.

Vitrified Brick Pavements for Country Roads

Abstract (by the Contract Record) of a comprehensive bulletin (U. S. Department of Agriculture) prepared by Vernon M. Pierce and Charles H. Moorefield—Chief of Construction and Senior Highway Engineer respectively of the United States Office of Public Roads

In forming a road bed upon which a brick pavement is to be constructed, the essential features to be considered are: (1) thorough drainage, (2) firmness, (3) uniformity in grade and cross-section, and (4) adequate shoulders.

Thorough drainage can be secured for any particular road only by means of a careful study of the local conditions which affect the accumulation and "run-off" of both the surface and ground water. These conditions vary considerably even in the same locality, and no set of rules can be given which would cover all cases. For example, the material composing the roadbed may be springy, and in this case the underdrains will probably be necessary. On the other hand, extremely flat topography may make it necessary to elevate the grade considerably above the surrounding land. The nature of the soil, the topography, and the rainfall must all be considered if a system of drainage is to be planned properly.

The second requirement, firmness, can be secured only after the road has been properly drained. Soils which readily absorb moisture cannot be properly drained in wet weather and should not be permitted to form a part of the subgrade. In order that the subgrade may be unyielding, it is also necessary that the roadbed be thoroughly compacted. In forming embankments the material should be put down in layers not over eight inches thick, and each layer should be thoroughly rolled. In excavation care should be exercised, if the material is earth, not to permit plows or scrapers to penetrate below the subgrade. The subgrade in both excavation and embankment should be brought to its final shape by means of fine grading with picks and shovels and rolling.

When completed the subgrade should be uniform in grade and cross-section, otherwise the foundation must be made unnecessarily thick where depressions occur, in order that its grade and cross-section may be uniform and its thickness not less at any point than that required. The subgrade should be repeatedly rolled and reshaped until the desired shape is secured. If curbs are constructed independent of the base they should be set before the final finishing, in order that they may be made to serve as a guide for this work.

The shoulders should never be less than four feet wide and should consist of some material which compacts readily under the roller and does not readily absorb water. Not infrequently one of the shoulders is made sufficiently wide to form an earth roadway parallel to the brick pavement. Such an arrangement serves to relieve the pavement of considerable traffic during favorable seasons and also affords some advantage to horse-drawn traffic. The general method of constructing shoulders for brick roads is not essentially different from that employed for other types of pavements.

Curbing

All brick pavements should be supplied with strong, durable curbing, both on the sides and at the ends. Otherwise the marginal brick will soon become displaced by the action of traffic, and their displacement will, of course, expose the brick next adjoining, so that deterioration might eventually spread over the entire pavement. Properly constructed curbing, on the other hand, will hold the pavement as in a frame and enable the brick to present their combined resistance to the destructive influences of traffic.

Satisfactory curbs may be constructed of stone, Portland cement concrete, or vitrified clay shapes made especially for this purpose. Wood has also been used for curbs to a limited extent, but when it is considered that the life of a brick pavement under ordinary conditions should far exceed the life of any wood curb which might be devised, the economy of employing a more durable material is readily apparent.

Stone curbing may be made from any hard, tough stone which is sufficiently homogeneous and free from seams to admit being quarried into blocks not less than 4 feet long, 5 inches thick, and 18 inches deep. On account of their ordinary homogeneous structure, granite and sandstone are probably more used for curbs than any other kind of stone.

All stone curbing should be hauled, distributed, and set before the subgrade is completed. The individual blocks should be not less than about 4 feet long, except at closures, and should ordinarily have a depth of from 16 to 24 inches, depending on soil conditions and on whether the curb is to project above the surface, forming one side of the gutter. The neat thickness need never be greater than 8 inches and, where the traffic conditions are not severe and the quality of the stone is good, a thickness of 6 inches will ordinarily prove satisfactory. Stone curb should always be set on a firm bed of gravel, slag, or broken stone, not less than 3 inches thick, or on unusually firm earth, and should be provided with a backing of the same material on the shoulder or sidewalk side. Fig. 1 shows a typical stone curb in place.

Where suitable stone is not readily available or when from any cause the cost of stone curbing would prove excessive, a curb constructed of Portland cement concrete may frequently be advantageously used. Concrete curbs may be constructed alone or in combination with either a concrete gutter or a concrete foundation. When constructed alone they should have approximately the same cross-sectional dimensions as stone curbs and should be constructed in sections about 8 to 10 feet in length. Figs. 2, 3 and 4 show the three common types of concrete curbs.

Vitrified clay curbing should be set in much the same manner as that described for stone curbing. The principal additional requirement is that, since vitrified clay is a lighter material than stone and the curb sections are ordinarily shorter, the bedding must be made correspondingly more secure in order to prevent displacement.

The Foundation or Base

A firm, unyielding foundation is one of the most essential features of a brick pavement. This fact can be more readily appreciated when it is considered that the surface of a brick pavement is made up of small individual blocks, any one of which might be easily forced down, causing unevenness in the surface, if the foundation were poor; and since the ability of the pavement to resist wear depends very largely on the smoothness of the surface, every reasonable precaution should be taken to prevent any unevenness from developing.

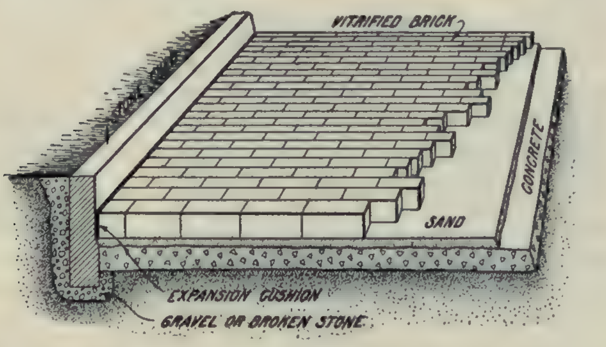


Fig. 1.—Proper method of constructing stone curb.

The proper type of foundation or base depends largely on the material composing the subgrade and the character of traffic for which the road is designed. Where the traffic is comparatively light and the subgrade is composed of some firm material which does not readily absorb water, a very satisfactory base may be constructed of broken stone. Where the traffic is comparatively heavy or where the material composing the subgrade is at all unstable, a monolithic concrete base should be used. Bases consisting of a course of brick laid flat upon a previously compacted layer of gravel or broken stone have sometimes been used, and pavements constructed upon bases of this kind, ordinarily called "double-layer" pavements, have in general proved satisfactory. At the present time, however, such bases can rarely be constructed at less cost than the more durable concrete bases, and they will therefore be given no further consideration here.

Broken-stone bases should be from 6 to 8 inches thick after compacting and should be constructed in two or more courses, just as in the case of first-class macadam roads. The materials used should conform in all respects to the ordinary requirements for similar materials used in constructing such roads; that is, the stone should be clean, hard, tough, and durable, and should be graded in size between certain reasonable, fixed limits. It should be uniformly spread on the road, either from dumping boards by means of shovels or from wagons especially designed to spread the material as it is being dumped. Where whole loads are dumped in one place and then spread out to the required depth, it is very difficult to obtain uniform density. Usually those spots where the loads are dumped are more densely compacted than the rest of the base, and this lack of uniformity very soon manifests itself by producing unevenness in the surface of the pavement. Broken stone should be compacted in the usual manner by rolling the base with a power roller weighing not less than about ten tons, and sufficient clean stone chips to fill the voids should be spread and flushed into the base while the rolling is in progress. When complete the base should present a surface uniform in grade and cross section and parallel to the proposed surface of the finished pavement.

Concrete bases are unquestionably better adapted for brick pavements than any other type. They are practically monolithic in form, nearly impervious to water, and possess a relatively high crushing strength. All of these qualities may be obtained with a relatively "lean" concrete if the subgrade has been properly prepared. Under ordinary circumstances a satisfactory base may be constructed of concrete composed of 1 part of Portland cement, 3 parts of sand, and from 5 to 7 parts of broken stone or screened gravel.

The sand should be clean and well graded in size, and the stone or gravel should conform to the usual requirements for coarse aggregate to be used in concrete construction.

Foundations for brick pavements have also been constructed of planks laid on sand, and in some instances of sand alone. These foundations have seldom proved satisfactory for any great length of time, and can, therefore, be economically used only when the pavement is to be constructed of an inferior grade of brick.

Sand Cushion

Since it is practically impossible to construct an absolutely smooth base, and since there is always a slight variation in the size of paving brick, owing to slight differences in the amount of shrinkage at the time of burning, it is necessary to provide an adjustable cushion of some kind between the base and the brick for correcting these slight irregularities, in order to secure an even surface and a uniform bearing for the brick. Sand has been found a most satisfactory material of which to construct this cushion, and is almost exclusively used for this purpose. The proper thickness for the sand cushion will of course depend on the extent of the inequalities above mentioned. Two inches is the most usual thickness, and has generally proved very satisfactory. One and one-half inches, however, is in many cases entirely sufficient.

The sand used in the cushion should be moderately clean and free from pebbles. If dirt or vegetable matter is present, it will soon be leached out and cause unevenness to develop in the pavement, while pebbles prevent the brick from securing a uniform bearing and ultimately produce the same result. It is also important that the sand should be dry when spread, especially if it is fine, because a comparatively small amount of moisture increases the volume of fine sand considerably, and moisture when present is not, as a rule, uniformly distributed. Even if it were uniformly distributed at the start, some spots would dry out more rapidly than others while the spreading was under way, and a lack of uniformity would thus be produced in the cushion.

In forming the cushion the sand is uniformly spread over the base to a depth slightly in excess of that desired, and is then smoothed off by drawing over it a template shaped to conform with the cross section of the finished pavement. The length of the template is ordinarily made equal to the width of the pavement where this is less than about 25 feet, and equal to half the width for wider pavements. Timber guides may be laid in the same direction as the pavement for the template to slide on, or the curbs may be made to serve as guides where this is convenient.

After the cushion is spread and uniformly "struck off" with the template to a depth slightly in excess of that required, it should be thoroughly compacted by rolling with a hand roller weighing from 300 to 400 pounds, and any depressions which form should be corrected. This is necessary in order to secure uniform density and to prevent unequal settlement of the surface.

Handling and Laying the Brick

The brick may all be hauled and piled at convenient intervals along the sides of the roadway before grading is begun, or, if more convenient, they may be delivered as needed on the work. Hauling over the finished pavement with wagons until it is complete and opened to traffic should be avoided. If the bricks are delivered on the work as needed, they should be unloaded from the wagons outside of the curb and carried to the pavers, either by hand or in wheelbarrows. Plank trackways should also be provided over the newly laid pavement for the wheelbarrows when they are used.

The brick should in all cases be uniformly piled by hand on the new pavement conveniently close for the pavers, and each brick should be so placed that the regular operation of picking it up and placing it in the pavement will bring the best edge up. This method of handling the brick requires somewhat more labor than the common method of dumping them from wheelbarrows, but it eliminates to a great extent the practice of picking out and turning over chipped or kiln-marked brick after the pavement is laid. This is very objectionable on account of the disarrangement of the sand cushion, which is frequently occasioned.

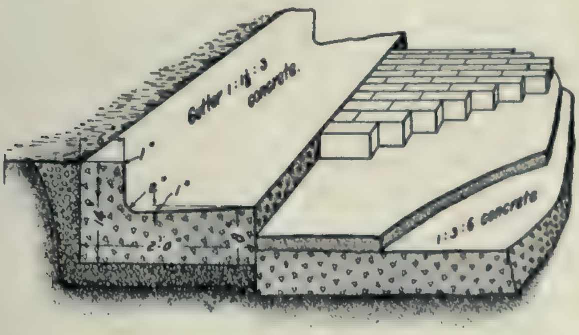


Fig. 2.--Concrete curb and gutter combined.

The brick should be laid on edge and in uniform courses, running at right angles to the line of the pavement, except at intersections; and in order to "break the joints" each alternate course should begin with a half brick. In laying the brick the pavers stand on the pavement already laid and, beginning at the curb each time, carry across as many courses together as they can conveniently reach. The courses should be kept straight and close together, and, if necessary, each block of eight or ten courses may be driven back by means of a light sledge and a piece of straight timber approximately 2 by 4 inches by 5 or 6 feet long, though no heavy driving should be permitted. The brick should also be laid close together in the courses.

After the brick are laid the pavement should be carefully inspected, for the purpose of detecting soft or otherwise defective brick. Misshapen or broken brick may be detected by the eye alone, and the soft brick by sprinkling the pavement with water. The soft brick appear comparatively dry while the water is being applied and comparatively wet after the sprinkling is stopped. All defective brick should of course be replaced by others which meet the requirements of the specifications.

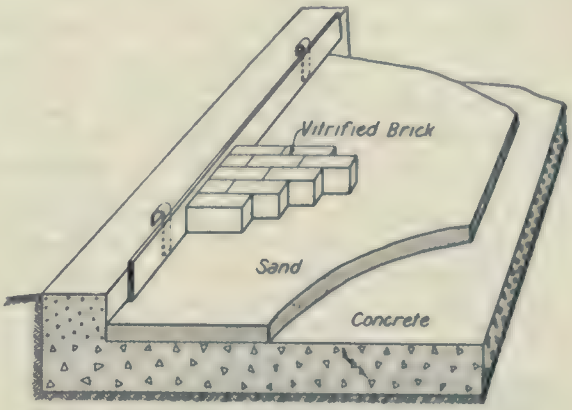


Fig. 3.—Making provision for expansion joint.

Truing the Surface

After the pavement has been laid and all defective brick have been replaced to the satisfaction of the engineer, the next step is to sweep the surface clean, and smooth out all inequalities by means of ramming and rolling. The rolling should be done with a power roller weighing from three to five tons, and the pavement should ordinarily be rolled in both longitudinal and diagonal directions. The longitudinal rolling should be done first, and should begin at the curbs and progress toward the crown. The roller should pass at least twice over every part of the pavement in each direction. In order to neutralize any tendency which the brick may have to careen under the roller, the number of forward trips over any part of the pavement should equal the number of trips backward over the same part.

In places where it is impracticable to use the roller for truing the surface—such, for example, as along the curbs or concrete gutters or around manholes—the brick should be brought to a true surface by means of ramming. For this purpose a wooden rammer loaded with lead and weighing from 80 to 100 pounds may be used. The blows of the rammer should not fall directly upon the brick, but should be transmitted through a 2-inch board laid parallel to the curb.

After the pavement has been trued up, as described above, it should be inspected again for broken or otherwise damaged brick, and also for those which have settled excessively, owing to some lack of uniformity in the sand cushion. All defects should be corrected, and the areas disturbed in making the corrections should be brought to a true surface by tamping or rolling.

Filling the Joints

In order to keep the brick in proper position and protect the edges from chipping it is necessary to fill the joints with some suitable material before the road is opened to traffic. The materials which have in the past been most commonly used for this purpose are sand, various bituminous preparations, and a grout made of equal parts of Portland cement and fine sand mixed with water.

Sand is the least expensive of these materials, but there are several very serious objections to its use as a joint filler: (1) It does not protect the edges of the brick; (2) it is easily disturbed in cleaning the pavement and is likely to be washed out by rain on steep grades; (3) it does not entirely prevent water from penetrating through to the foundation; and (4) it does not bond the individual brick together and so enable them to present a concerted resistance to traffic.

The bituminous fillers vary considerably in quality and efficiency, but all are more or less unsatisfactory. One of the principal objections to their use is based on their tendency to run out of the joints into the gutters during warm weather and to crack and spall out during cold weather. This tendency can, of course, be partially overcome by exercising proper care in selecting the materials. It should also be noted in their favor that brick pavements, the joints of which have been filled with bituminous preparations, are ordinarily less noisy at first than those in which a Portland cement grout filler has been used. The grout filler is unquestionably very much superior from a standpoint of durability, however, and the excessive noise under traffic which has been frequently observed in connection with its use can be largely eliminated by the use of proper bituminous expansion cushions along the curbs. It is, therefore, recommended as better adapted for filling the joints in brick pavements than any other material which has been commonly used for that purpose.

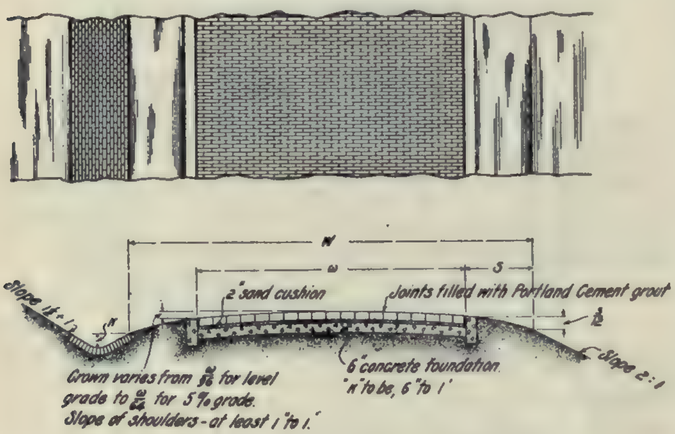

W
w
S
2" sand cushion
Joints filled with Portland Cement grout
Slope 2:1
6" concrete foundation
"n" to be, 6" to 1'
Crown varies from w/96 for level grade to w/64 for 5% grade.
Slope of shoulders - at least 1" to 1'.

Fig. 4.—Typical plan and section for brick road.

When the joints of a brick pavement are properly filled with Portland cement grout the individual brick are firmly bonded together and the pavement is thereby practically converted into a monolith. Moreover, since the material composing the joints scarcely wears more rapidly than the brick, the edges of the bricks are well protected, and the importance of this feature has already been pointed out.

The most satisfactory method yet devised for mixing and applying the grout filler may be described as follows: Grout boxes, constructed in such manner that when resting on a level platform one corner will be lower than the others, should first be provided. The number of boxes required depends on the width of the pavement; ordinarily one box to each 10 feet of width will be found sufficient. The grout, which should be put on in two applications, is prepared in batches each of which consists of a quantity of cement not exceeding one sack, a like amount of fine, clean sand, and water. The sand and cement should first be thoroughly mixed dry and sufficient water then added to produce a liquid mixture. The consistency of the mixture for the first application should be approximately the same as that of ordinary cream, and for the second application it should be somewhat thicker.

The pavement should be cleaned and thoroughly sprinkled as a preliminary to making the first application of grout, and it should be kept moist by gentle sprinkling while this application is being made. The grout should be swept into the joints immediately after it is removed from the boxes and spread upon the pavement. For this purpose a coarse rattan or fibre push broom should be used in the first application and a squeegee in the second application. The squeegee is usually made by clamping a piece of four-ply rubber belting or some other similar material, about 6 by 20 inches in size, between two pieces of board and attaching a suitable handle. The grout in the boxes should be continually stirred until the last of it is removed, otherwise a separation of the sand and cement will almost certainly occur.

The first application should proceed about 50 feet in advance of the second. Usually both applications are made by the same crew of laborers. They simply turn back after having covered the allowable distance with the first application and, mixing the grout in the same boxes, bring up the second application. The second application of grout should completely fill the joints flush with the top of the brick.

After the joints are filled as described above and the grout has taken its initial set, the entire surface should be covered to a depth of approximately 1 inch with sand or fine earth. This is done to protect the pavement from the weather and to keep it in a moist condition while the grout is hardening. If necessary, in order to keep the covering moist, it should be occasionally sprinkled for several days after it is spread.

The covering should be permitted to remain on the surface for at least ten days, and during this period the pavement should be kept entirely closed to traffic. If the weather is unfavorable, the length of time during which traffic is kept off the road should be increased.

Expansion Cushions

It has been customary in the past to provide both longitudinal and transverse bituminous expansion cushions in grout-filled brick pavements, but recent practice has demonstrated that the transverse cushions may be advantageously omitted if proper longitudinal cushions are provided. The principal objection to the use of transverse expansion cushions is based on the fact that the material composing the cushions frequently softens during warm weather and runs out toward the curb, thus leaving the edges of the adjoining brick exposed to destructive impact from the wheels of passing vehicles. Even if the cushion consists of a material which does not run in warm weather, it is necessarily softer than the brick, and the natural result is still the development of unevenness in its immediate vicinity. No such objection can exist concerning longitudinal expansion cushions, however, if they are placed adjacent to the curbs and constructed of proper material. They not only furnish a means for the pavement to expand and contract with changes in temperature, but they also eliminate to a large extent the disagreeable rumbling which has been so frequently associated with grout-filled brick pavements. The bituminous material of which the expansion cushions are made should be such as to remain firm in summer and not to become brittle in winter. It should also possess the quality of durability.

Expansion cushions should be provided for at the time the brick are laid, by placing a board of the required thickness on edge adjacent to each curb, as shown in Fig. 3. Small iron wedges, such as are shown, may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as three-eighths inch for very narrow pavements. It is generally agreed that the thickness of the cushion should vary with the width of the pavement. The following suggestions for proportioning the cushion are offered as being fairly representative of the best practice:

Ratio of thickness of cushions to width of roadway:—
Width of roadway, 20 ft. or less; thickness of cushion ½ in.; 20 to 30 ft.,—¾ in.; 30 to 40 ft.,—1 in.; over 40 ft.,—1¼ in.

Cost of Brick Pavements

The cost of brick pavements varies widely and is affected by so many influences that it is difficult to attempt to derive a general expression showing the relation between probable cost and local conditions. The prices of brick, as also the prices of the various materials entering into the foundation, vary greatly according to the locality and the freight rate. The cost and efficiency of labor is also far from being constant. Furthermore, the material composing the subgrade and the method of preparing it may exert a marked influence on the cost of the pavement. The following statements regarding cost, then, must be considered as representing average conditions, and care must be exercised in applying them to special cases. They are intended as a guide in preparing estimates of probable cost.

The grading is usually paid for by the cubic yard, and the cost, of course, varies with the character of the soil and the necessary amount of excavation. In light, easily loosened soils, grading may usually be done at from 25 to 40 cents per cubic yard. In hard earth containing more or less loose rock the cost per cubic yard generally runs from 40 to 75 cents, while grading in solid rock may sometimes cost as much as $1.50 per cubic yard. The cost of the rough grading should be considered entirely apart from the cost of the pavement.

The cost of shaping and rolling the subgrade after the rough grading is completed will ordinarily vary from 3 to 5 cents per square yard. This cost should be included with the other items which make up the cost of the pavement.

The cost of the curbs varies with the character of the material used. Stone curbs ordinarily cost from 25 to 75 cents per linear foot, while curbs made of Portland cement concrete cost, as a rule, from 20 to 50 cents per linear foot. The higher prices for the concrete curbs apply principally to special cases requiring extra form work or considerable extra material.

The cost of the foundation depends largely on the cost of the materials with which it is constructed. Gravel or broken stone can usually be spread and rolled at from 5 to 7 cents per square yard, while the cost of these materials, delivered, varies from $0.60 to $2 per cubic yard. Mixing and placing concrete usually costs from 35 to 75 cents per cubic yard, according to the amount of work to be done and the methods employed, and the cost of the materials, delivered, ordinarily varies from $2.50 to $4.50 per cubic yard of concrete

The cost of paving brick at the kiln varies from about $13 to $16 per thousand. Estimating 40 brick to the square yard, each 1,000 brick cover approximately 25 square yards, which makes the cost at the kiln per square yard of pavement vary from 55 cents to about 65 cents. These figures mean very little, unless the kiln is located conveniently near where the brick are to be used, for freight charges not infrequently amount to more than the cost of the brick.

A force consisting of one paver and five laborers should place on an average about 220 square yards of brick per 10-hour day; while supervision, rolling, and incidental expenses are ordinarily equivalent to the cost of hiring about three and one-half additional laborers.

If C = cost of cement per barrel, S = cost of sand per cubic yard, A = cost of coarse aggregate per cubic yard, B = cost of paving bricks per 1,000, and L = cost of labor per hour, with all materials considered delivered on the work and all costs expressed in cents, then the probable cost of constructing a brick pavement, including the subgrade, a 6-inch concrete foundation, and suitable curbs, may be estimated by substituting in the formula:

Cost per sq. yd. $= 1.90\ L + .213\ C + .138\ S + .157\ A + .040\ B.$

The cost as estimated from this formula should usually be increased by about 10 per cent. to allow for wear on tools and machinery and to guard against unforeseen contingencies. If it is desired to use a different thickness of foundation, it is safe to assume that each inch subtracted or added to the thickness of the foundation will make a corresponding difference of from 8 to 12 cents in the cost per square yard.

Maintenance of Brick Pavements

If brick pavements are properly constructed at the start, the work of maintaining them is very slight. Under the closest inspection, however, some inferior material is likely to become incorporated either in the foundation or in the surface, and it is therefore very important that a brick pavement be very carefully watched for the first few years of its life to see that no unevenness develops either because of defective brick having been used in the surface or because of insufficient support from the foundation at any point. Whenever any unevenness develops, it should be immediately rectified. Otherwise the pavement will become irregularly worn in the vicinity of the defects, and expensive repairs will eventually be necessary.

Not infrequently weak spots develop in broken stone or gravel foundations, owing to surface water finding its way through joints in the pavement which have not been properly filled with grout. Careful observation of the joints should therefore constitute a part of the early maintenance work, and any defective joints discovered should be immediately remedied. Where the foundation is constructed of concrete, however, slight defects in the joints seldom result in any very serious damage.

If care is exercised to correct all defects which appear within the first few years of the life of a well-constructed brick pavement, the work of maintaining the pavement proper should thereafter, except for cleaning, be almost negligible for a considerable period. The shoulders and drainage structures, of course, need occasional attention, just as in the case of any other pavement, but if they are properly constructed at the start repairs will usually be very slight.

The life of a well-constructed brick pavement can not be estimated with any great degree of exactness, first, because the traffic conditions are constantly changing, and, second, because no brick pavement which has been constructed in accordance with the best modern practice has yet worn out. Such measurements as have been made of the amounts of wear sustained by given pavements during comparatively long periods of years have not been sufficient to warrant any very definite conclusions as to the probable terms of service, though they indicate that good paving brick wear very slowly under ordinary traffic. It is evident that in order to secure the full benefit of this excellent resistance to wear the surface of the pavement must not be permitted to become uneven because of the failure of a brick here and there.

Conclusion

Before concluding this discussion of brick pavements, it would seem desirable to emphasize the importance of proper engineering supervision. In the past many communities have expended large sums in efforts to improve their public highways without first having secured the services of some one competent to plan and direct the work. The results have usually been very unsatisfactory under such circumstances and have frequently served to discourage further effort. One of the mistakes most commonly observed consists in constructing some expensive type of pavement on a road where the location is faulty or the grades are impracticable. Not infrequently sharp angles in the alignment or abrupt changes in the grade, which might be easily and inexpensively remedied by an experienced engineer, are left to impede traffic throughout the life of a costly and perhaps durable pavement.

Even in constructing common earth roads it is doubtful economy to dispense with the services of a competent engineer, and if any considerable quantity of work is to be done, such services should certainly be secured. Since brick pavements are probably more expensive to construct than any other type of pavement at present used for country roads, it is all the more important that their construction should be carefully planned and well executed.

In a number of English towns and cities, large mirrors have been erected at important road intersections to enable drivers of motor cars approaching the junction to see whether a car is approaching the corner on the other road. A recent United States Consular report quotes the "Times of India" as stating that the municipality of Bombay will erect a mirror 10 ft. long and 3 ft. high, at a dangerous street intersection in Bombay. The use of mirrors for thesame purpose is also reported at Glencoe, Ill., where a mirror 8 ft. long and 6 ft. high has been placed at the intersection of two much-used streets. The idea is a simple one and may be worth extensive adoption. Probably it would be necessary to provide for the systematic cleaning of such mirrors if erected, however. One at a much-used road intersection, exposed to the dust and weather, might soon become so obscured as to give no clear indication, in which event it might be a source of danger rather than of safety.

The Quantity System of Estimating

THE American Institute of Quantity Surveyors calls attention to the rank uncertainty of the present method of estimating, which continues to occupy the attention of the architectural and building fraternity, and of those owners who do not seek to beat the contractor and material men. It seems difficult to demonstrate to some owners how a straight and accurate bill of quantities to estimate upon helps them to get better work, a square deal and a satisfied contractor.

It is the experience of those who have long been engaged in the practical advocacy of the quantity system in this country to find that, although the average owner will strenuously deny trying to get "something for nothing" out of a contractor, they, for the most part, really do this very thing. They will hire a certain type of architect, not altogether for his talent as an artist, but for the purpose of helping them get the best of the contractor. This is attempted robbery, from whichever way we may look at it. Can we wonder if, in self-protection, the contractor retaliates?

Such owners appear to argue in their own minds something like this: I (the owner) know something of the building business, and doubt if this contractor fellow knows enough to get ahead of me and my architect, and he surely will not think to keep a few cards up his sleeve?

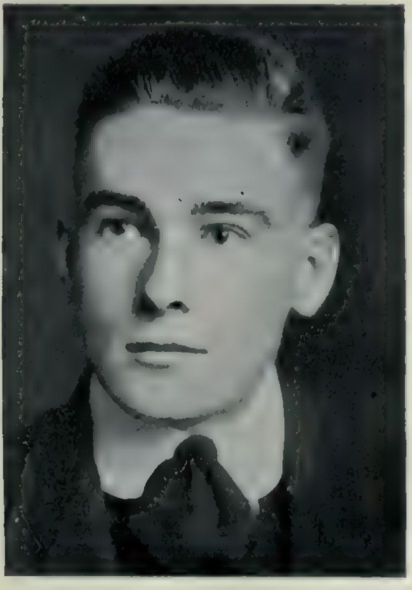
But even supposing by chance my tricks are trumped too often and I am likely to lose! Is not the referee under the contract in my employ? What do I pay him for? He must protect me, for am I not the owner? I must not let my adversary win, notwithstanding his money is invested in my building and regardless of his practical knowledge, which must also be used to my advantage. Besides, I do not have to play the game every day. The next time I do I will look for a different man, one belonging to my fraternity, one just starting in business and anxious to please preferred.

And this is how the building game is too often played. Common custom and convention compels a certain type among the unprivileged class of architects (those who are not altogether financially independent of clients) to follow those methods which lead to possible future business. That is but human nature, and the human element of self-interest is more often than not apparent.

But if a clear, detailed bill of quantities is once made the basis of the contract—i.e., so much labor and material for so much money and no more (and no less)—then it will help to relieve the other and better type of architects, who do try to be fair to both contractor and owner, from embarrassing positions and decisions, and from otherwise acting in judicial capacities under building contracts, which often accounts for the loss to them of business friends and ultimate loss of professional practice.

Prize-Winning Design for Power Station on the Winnipeg River

REPRODUCED herewith is the winning design for a power developing station at Du Bonnet Falls, on the Winnipeg River. The design, of which Mr. Harold R. Watson, of Toronto, is the author, was awarded First Prize in a competition conducted by the Department of Architecture of the University of Toronto. It is understood that Mr. Watson's design will be adopted by the Government.

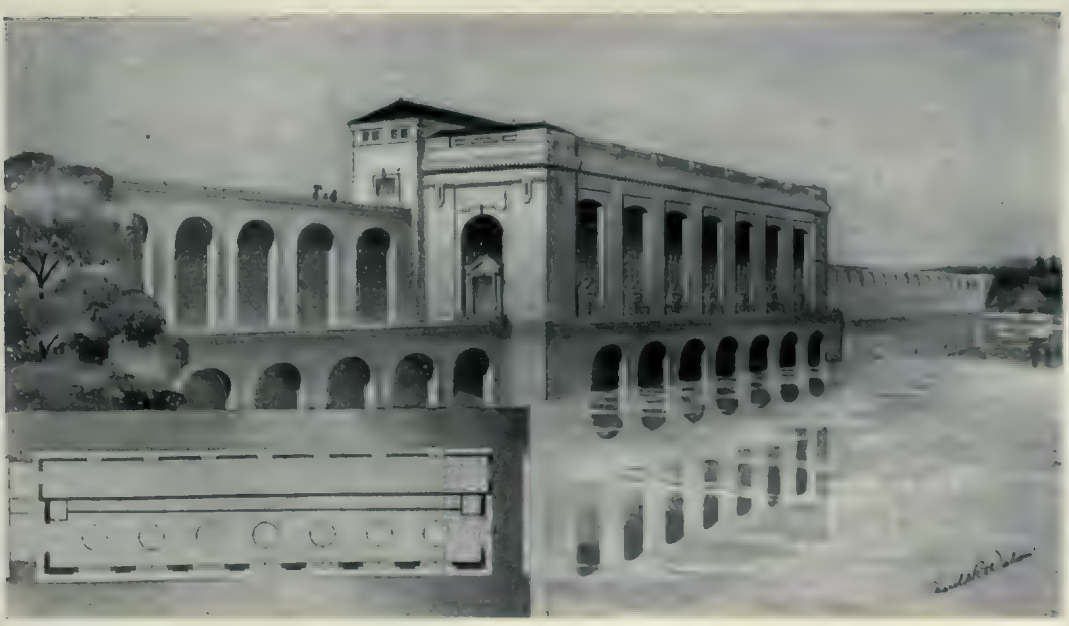

Mr. Harold R. Watson, of Toronto, whose design is reproduced below.

The proposed building will be 80 x 312 feet. The site at Du Bonnet Falls was chosen after a careful survey of the Winnipeg River, which at this point has a drop of some sixty feet, and affords an opportunity for a lock connecting the two levels of the river, and making it navigable for large boats. The building is to be constructed of reinforced concrete and steel. It will contain seven units on 41-ft. centres ,as shown in the block plan to the left of the illustration. An additional seven units are to be added later, thus making the structure over 600 feet long. The design calls for two reinforced concrete bridges to connect the building with the mainland.

The illustration gives a good idea of the character of the building and of the immense scale of its side bays, each of which is 25 feet wide and 40 feet high, constructed of steel sash. The building will be roofed in red tile.

Mr. Watson received his early education at the Technical School, Toronto, from which he graduated in 1913, entering the Department of Architecture in the University of Toronto with Class '17. He has had considerable experience, having been on the staff of the Technical School for two seasons. Mr. Watson intends to specialize in architectural design.

Considerable interest has prevailed in England for some time over the suggestion of using rubber for street pavements. Trial sections of such pavement were laid in the Old Kend Road, in London, some time ago, as this street carries some of the heaviest traffic of the city; and recently a specimen of this pavement was exhibited. The wood block pavement adjoining had worn down from an eighth to a quarter of an inch, but in the same time the rubber-capped wood blocks appeared as good as new; and it would appear from these tests that rubber pavements would be so durable as to make them an economic investment.


Prize-winning design for power station. By Harold R. Watson.

Essential Requirements in Concrete Pavements

IN the laboratory, much care is taken to conserve every value that is placed in a concrete specimen. Many contractors are inclined to feel that when they have stood watch and fulfilled the task of assembling material, mixing and placing concrete, they have finished. This is far from the fact. This work is only the beginning of a concrete operation; conditions are made favorable for the real agent, the silent worker "chemical action," which work will be complete in proportion to the manner in which they have done their part.

This discussion will be limited to concrete when used for street or road pavement, and it is desired to call attention to what have been found to be small and often neglected but important points. The following are most often underestimated, and if there is failure, it can be traced to the neglect of one of these: density, contraction, sub-grade, protection.

Density

Notwithstanding there is much importance in the well-known theme of gradation of aggregate, this is not the most important. Care must be taken in placing and the use of the proper amount of water. It is not difficult to calculate and prepare the mixture that will contain the least voids. On the other hand, it is just as easily shown that this perfectly balanced mixture can be made to contain maximum voids, simply by adding surplus water. Water gauging is too imperfect; slight variations in size of batch, in combination with the hit and miss mechanism of water gauges, are sufficient to produce a different amount of water for almost every batch, notwithstanding the importance of this feature.

For example: If a specimen be taken from a properly mixed and gauged mixture, and 4 per cent, water added to batch and another specimen made, it will be found that the latter will contain much greater voids by reason of its agreeable consistency to catch and hold in its mass small air bubbles, along with water globules from clarification. Most of such additional voids will not be shown by absorption tests, and can only be closely approximated by weight.

To illustrate: Take some soap bubbles and enclose them in a most granular mass, and offer agitation or compression, the dissipation is complete; then place some in the interior of a mass, the consistence of thin-pour, and try to remove them by tamping or compression. It will be found the seasoned specimen will contain them just the same, and though they may be broken up into smaller cells, their full volume will remain in the mass.

The voids created by the addition of surplus water is not the only nor the principal damage done by reason of this excess water. Perhaps a greater damage is done by carrying with it, in suspension, particles of cement flour so important in the hardening process of other portions of the mass, which upon evaporation develop a lining to the cells almost impervious to moisture in an absorption tests.

There are very many things depending upon conditions when chemical action begins to take place in a mass of concrete. If the mass is highly porous, from excess of water, the crystals will be largely of needleshape, with hexagonal plates in the matrix films. If the mass is more dense, hexagonal plates and crystals will abound, and if the mass is of high density the bond will be hexagonal crystals planted in colloidal films. This last condition cannot exist if too much water is used in the mixture, unless much effort is used in tamping, or until an osmotic state is established in the mass.

The proper amount of water is the amount nearest to, without developing, clarification, and will vary with absorbing capacity of ingredients. Water-tamped should not be used for street pavement.

Contraction

Expansion is neglible if contraction be properly provided for, since expansion comes from only one cause, that of rise of temperature (and absorption in porous concrete, which should not be used in pavement), while contraction comes from several causes, some of which begin to operate almost immediately after the concrete is put in place, as follows:

(a) Settlement during moments of clarification(if such) which may lessen stress between solids.

(b) Shrinkage during drainage period (if any) which may open lines for percolation.

(c) Shrinkage after initial set has taken place. This form of contraction is probably the most damaging to concrete and is greatest in porous concretes, doing damage in the form of unseen cracks that develop later, leading one to mistake them for those of more recent origin.

(d) Crystallization.—Crystal and colloidal bonds like many other formations grow less as they grow older and stronger. This is another form of contraction that goes on for several months; in connection with this it will be understood that where moisture remains in the mass, these bonds may grow stronger without losing in size, and in the end will make a stronger bond.

It, therefore, becomes important that as much as possible of the original moisture be kept in the mass and as long as possible. Water sprinkled upon the surface of a too rapidly drying pavement will not answer, as such water vaporizes and rises in the air. More concrete is permanently damaged by this form of contraction by shrinkage, caused by too quick drying-out, and the cutting short of the hydration of the elements, than from poor material and mix.

Sub-grade

It is seldom that an engineer objects to the amount of rolling of sub-grade, except to get as much as possible, claiming it is impossible to get too much.

More pavement is damaged by over-compression of the sub-grade than by under-filling. If a sample of earth be removed and subjected to great pressure and again placed in the earth and after a time be excavated, it will be found that this sample has restored itself to the natural density, or at least to that of the earth surrounding it. Uneven compression of the subbase is responsible for much damage, commonly called "buckling of pavement" at center or quarter. It is seldom an action of the pavement, but is caused by a raising up of pavement at points where over-compression exists in the sub-soil. The over-compression is highest at the center, since this is the easiest place to operate the roller, there being less liability of getting into the curb and gutter in the case of streets, and off in the ditch in the case of roads. Transverse cracks are often started by some form of shrinkage and extend when the sub-grade brings the restitution of its volume back to nature.

All clays are highly compressible—some of those on which tests were made restored themselves in one year, some in two, others in three or more, but all of them reverted to their natural volume in due course of time.

Where a soil is easily compressed, this should be done with caution, and in the reverse case, it usually gets little compression.

Protection

Concrete may be able to carry a great load at the age of one month, but will not resist the abrasive action of traffic. When one stone is displaced, the impact is multiplied upon its neighbor. Surface stones should be protected from actual contact with abrasion of traffic for a period of some months.

This is made practical by the placing of a surface coating in the right manner at the right time, and is well worth the small cost.

Maintenance

Slight variations in the grade of any pavement should receive immediate attention, as small defects will in a short time develop great damage.

Load Tests on Brick Piers

At a recent meeting of the National Brick Manufacturers' Association an interesting paper based on an investigation now being conducted in Pittsburgh by the U. S. Bureau of Standards, in order to determine the physical properties of large piers when tested to destruction, was presented by Messrs. J. H. Griffith and J. G. Bragg, members of the staff of the Bureau. It is of interest to mention that Prof. A. V. Bleininger, the well-known ceramic chemist, who has addressed several meetings of brickmakers in Canada, acted in an advisory capacity throughout the investigation.

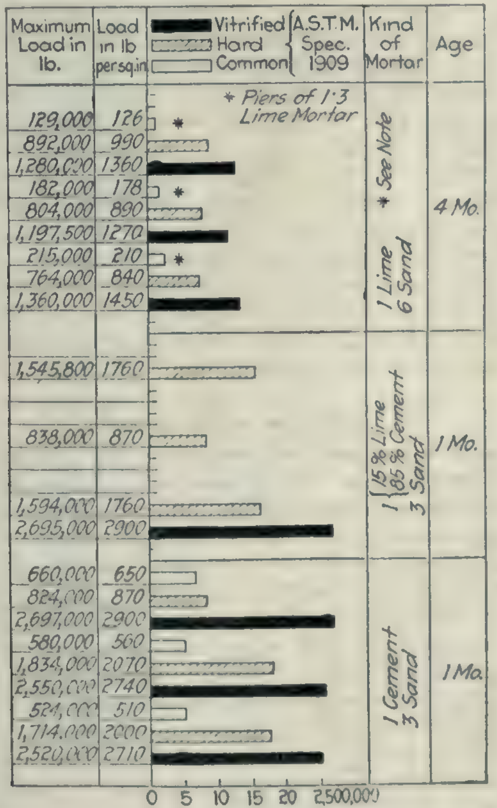


Fig. 1.—Data of load tests.

So far, more than twenty-two piers have been tested.

As nearly as possible each pier was 30 in. square by ft. high, except two piers which were built 5 ft. high. Each pier averaged 44 courses. The joints were about 5/16 in. thick. The qualities of brick used, kinds of mortar, ages of piers and results of tests are tabulated in Fig. 1. Three typical styles of bonding were selected for test—header every other course, every fourth course and every seventh course; thus there were three types of bonding for each set of piers. One of the 5-ft. piers had steel-mesh reinforcing placed in every horizontal joint; the other, every four courses; but the results obtained were inconclusive (see Conclusion No. 7).

Method of Test

Each pier was constructed in the laboratory on a steel plate 1 in. thick, leveled on the floor. The plate surface which was to rest on the base of the testing machine was planed. A plate 1½ in. thick, with eyebolts for crane connections, was laid on the top of the finished pier, connected with the baseplate by four vertical rods, so that the piers could be filled easily and set in the testing machine without injury. The top plate was removed after the pier was in place. The pier was leveled, the top covered with a thin coat of plaster of paris, and the head of the machine brought down, squeezing out superfluous material. The pier was then left for several hours to allow the plaster to set. Measurements of compression were made at several corners, as were also transverse measurements and strains between bricks.

As shown in Fig. 1, bricks laid up in cement mortar stood up best. Cement-lime mortar gave almost as good results. Piers using lime mortar were only about one-half as strong as those with cement; but it should be noted that vitrified brick laid up in lime mortar withstood a pressure of more than 1,400 lb. per sq. in. The weakness of these piers was caused mainly by an almost entire lack of carbonation of the mortar on the interior, rather than by a special efficiency of lime mortar when properly aged.

Characteristic Failure of Piers

At about three-fourths maximum load vertical hair-cracks began to appear. With continued loading the piers broke up into vertical laminations. This condition was induced by the bending of the individual bricks, causing them to split transversely. The bending is the result of non-uniform bearing proceeding from lack of homogeneity of texture in the pier, in an individual brick or in the mortars.

The progressive action of this cracking is most interesting. Sometimes very early in the test small haircracks formed in the upper or lower surface of a brick, usually just under or near the vertical joints, and widened at the surface as the load increased. Finally, subdued sounds were heard, which increased in volume until, in the case of vitrified and hard-burned brick laid up in lime mortar, a succession of popping sounds occurred, frequently increasing until the sound became a loud "bubbling" in the final stages. When a brick split, the ones above and below tended to do the same, until the structure became a succession of strips, and failed either by spalling out in large masses or as a group of thin, isolated columns.

The following are the main conclusions reached in the investigation:

(1) The strength of piers under vertical loading bears a close relation to the kind of brick used and the quality and age of the mortar.

(2) The low strength of piers laid in lime mortar is

attributed in the main to insufficient aging, with a consequent lack of a proper carbonation of the mortar.

(3) Experiments seem to indicate that the strength of a pier is largely independent of the course bonding. The real function of bonds is to maintain a certain integrity and monolithic action of the masonry against initial strains induced through setting and "drying out" of the mortar rather than to give any great increase of vertical strength.

(4) The elastic limit of the piers laid up in cement and cement-lime mortar was approximately one-half the maximum load.

(5) Piers fail through a tendency to separate into vertical strips caused by bending failure in the individual brick produced by unequal distribution of the vertical load over the cross-section. This is aggravated by ineffective shearing and adhesive strength of the mortar.

(6) A high modulus of rupture of the brick is more desirable than superior crushing strength. Higher modulus of rupture would be realized in practice by increasing the thickness of the bricks or by laying them on edge.

(7) A further study of the action of steel-mesh reinforcing in the horizontal joints is recommended in order to ascertain the load efficiency of piers having an outer shell of hard brick with an inner core of softer brick. This construction would be used where a high-grade brick is not easily obtainable.

The Construction of Concrete Houses*

OWING to the increased use of concrete in industrial and business buildings, remarkable developments have taken place in this branch of the industry, though until recently little advance has been made in the class of buildings of residential character. Dampness is the principal objection to concrete construction. It is easy to see that if a solid wall thoroughly chilled has warm air suddenly impigned upon it, the moisture in the air will be condensed as with an ice water pitcher on a warm day. Now ordinary, monolithic concrete of a fairly rich mixture is practically waterproof. The condensed water is not readily absorbed by the wall—hence the damp condition that follows. Brick, tile, and many other materials are absorbers of water to a certain degree; wood, to a large degree.

It is quite clear, then, that if we want to eliminate dampness due to sweating, we must approximate the conditions of such materials as do not sweat, and a construction that cannot be damp under any conditions.

Various Types

To begin with, there is the typical wet mix. Here the water practically carries the cement in saturated solution to all surfaces of the aggregate and deposits it there, enough mixing and churning being given to distribute the cement-saturated water evenly. This type has many advantages as to ultimate strength and waterproof qualities, and is widely specified, but it is not adapted to residence work, either as a final material or as an economy proposition.

At the other extreme is the typical dry mix (used fifteen years ago in foundations and to some extent in the concrete block industry today). This type, on account of excessive porosity and the great amount of tamping or pressure needed, is equally unfitted for residences. Midway in the scale, however, is another kind of concrete that has some remarkable properties—which are just what the house builder is after.

Voids Wanted

This mix should have primarily an excess of the medium-sized aggregate and sand. That is, we want voids, but we want them very, very small and not connected, so to speak. In other words, we want to approximate the structure of wood or brick, not the closeness and homogeneity of steel. It should be wet and plastic like mud, but with no surplus of water, and requires mixing for a comparatively long time. Fnally, it should be rapidly cured or dried out by removing the forms as soon as possible.

The qualities of this product are peculiar. It will absorb water to a moderate amount without being subject to leakage, and attains considerable tensile strength while still green; also it does not exert much pressure when setting, and is not nearly so subject to expansion and contraction as a wet mix. Cracks will often reknit twenty-four hours after final set, on application of pressure. Frequently scrapings from a wall two days old catch on the wall below and set up again, adhering so firmly that a cold chisel is required to dislodge them. Further, such a mix when cast in wall form is strong enough to hold four feet of concrete above without side support, and yet is soft enough to cut like cheese at the bottom, and is an ideal material for certain purposes.

But what we started after was, to begin with, a material approximating brick and wood, with little tendency to sweat—and finally a construction that would nullify whatever tendency there was. The last requirement is met by the double wall—that is, two concrete walls, with an air-space between. To carry this construction through, however, economically and structurally, several serious difficulties had to be overcome.

Problems to Be Solved

First,—some practical construction method was needed to transmit and equalize the weights coming on the inner and outer wall. Obviously, two thin slabs stuck up on edge, one slab taking all the floor weights and the other only its own weight and part of the foot and tied together merely at intervals by through ties at right angles to walls, was not altogether satisfactory, unless each wall was over thick; also comparatively thin slabs of any length or height are particularly subject to temperature shrinkage and resultant cracking, thus requiring much reinforcing steel.

Second,—a double-wall construction calling for the use of core forms presents the item of considerable expense, and many practical difficulties arise if a standard construction is use. Again, the ordinary form methods are practically out of the question, due to certain special conditions peculiar to house building, viz., number and variety of openings, irregularity of walls, necessity of placing beams without waiting a long time, or the great number and variety of chases, plugs, or openings to be anticipated.

Third,—in a general way, the point of economy so governs the whole question of residence work that unless it can be shown clearly that concrete is at least as cheap as other masonry construction, it is idle to consider whether or not it is satisfactory as a whole.

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* From a paper read at the first annual convention of the American Society of Engineers, Architects and Contractors.

Concrete construction has grown along certain definite lines, the general experience being that forms and form work are comparatively expensive, but that the mixing and placing can be done quite cheaply by machinery, mixer, and chutes, provided there is enough cubic yardage to pay the cost of installing the plant and running the system. This is based on the use of a very wet liquid mix, as this is the only kind that will flow readily. So that, to a very great extent, working along these lines, all endeavor has gone into cheapening the handling end; very little, until recently, into investigating conditions of the mix or improving the forms. This, of course, is largely due to the ease of handling a wet mix, and the fact that if enough storeys are to be cast in a high building the initial cost of the forming is divided sufficiently often to bring out a very reasonable total.

But in the smaller type of building and residence, we have an entirely different proposition. The wet mix is not a satisfactory material; the yardage will not justify an elaborate handling plant; and the forming cannot be standardized upward.

The savings here must be made in another way, by the method and form themselves, in cutting down the labor of setting them up and taking down, in eliminating to a great extent the cost of shifting, in providing an automatic plumb and alignment scheme that is independent of care and trade skill, and lastly, in using standard forms in big units that can be used on any and all buildings, irrespective of varying wall lengths—and all this with little or no depreciation of forms and equipment. This can be accomplished by a scheme of standardization longitudinally. Previously the small cast concrete building had apparently been conceived entirely as a monolith, somewhat as the first sidewalks were made, without joints.

The introduction of a separately built joint member in connection with cast walls and girders made possible the satisfying of the various form criterions noted above, and also did away with the structural difficulties previously mentioned as connected with the double wall.

In a concrete residence on Long Island, the walls of which were recently completed by this method, the entire cost of cellar and walls, including setting and shifting forms and depreciation, averaged $5.50 a cubic yard. There were 385 cubic yards in the entire building. The dimensions of the building were 62 ft. 6 in. by 41 ft. 6 in. by 23 ft. 6 in. from first-floor beams to roof plate. The approximate time of erection above first-floor beams was fourteen working days.

As the walls largely consisted of two 4-inch slabs, each square foot of wall surface represented the equivalent of two-thirds of a cubic foot, which gave a cost per square foot of wall surface of 14 cents. The conveying apparatus used consisted of a 5-cu. ft. mixer, with hoist and bucket dumping into a very short, steep chute, which in turn emptied into wheelbarrows. No scaffolding whatever was erected, runways over horses and on second floor beams being substituted.

There is one other factor in the general problem, namely, the overhead cost of concrete work. The tendency has been in the building art to develop concrete work as a thing apart for large buildings and structures requiring great strength. Architects and engineers have become accustomed to use a standard form of specification whose requirements, if lived up to, furnished a product suitable to heavy structures, and little else. To require an ultimate strength of 2,500 pounds to the square inch where the maximum strain would never be 25, is certainly keeping on the safe side, but obviously a little absurd and very uneconomical.

The result has been that (1) in small work the requirements have not been lived up to, a practice which has been more or less condoned by architects on account of the high factor of safety; and (2), the segregation of the skilled concrete workers into a class employed entirely on big work.

But concrete is rapidly coming in as a universal building material; and, with the enormous demand for cement and gravel, we shall find it inexpedient to be wasteful with it, either directly or indirectly, and there will soon be a real demand for skill in its use as a plastic building material, which will automatically remedy the present condition.

Public Speaking for Engineers

FROM experience with several hundred young and middle-aged engineers, writes F. H. Newell in the course of a recent letter to The Engineering News, I may safely assert that there is not one out of ten, or possibly one out of a hundred, who has shown the ability to write the story of an important public work in such a way as to be readable by the public. It seems as though all natural ability in expression had been destroyed by the educational methods or the technical training. For example, a young engineer writing home to his family gives a most fascinating account of his work; but ask him to write out the larger facts for publication and he immediately begins a cramped, dull description of relatively unimportant details or technicalities concerning which few people care to read. He seems to lose his sense of proportion or his perspective. He is unable to adjust his mental attitude if he is conscious that the material he is writing is to be read by any one except his favored correspondent.

Successful engineers must be men of imagination, men who can picture in their own minds the great possibilities latent in unattractive surroundings. This imagination so necessary for success is often unavailable as far as giving information to the public is concerned. The preservation of the freshness of statement and clearness of vision are among the important things which seem to be lost by the time a young engineer has achieved success in other lines.

It is of the highest importance, not merely to the engineering profession, but to the public in general, that we endeavor to bring forward systematically the man who can and will write out short interesting descriptions of engineering works and achievements. Each engineering society should regard it as a duty to the public and to the profession to find among its members the man who can do this and to encourage him in every possible way to aid in the diffusion of correct information and in the education of the local public, not through technical journals, which the public does not read, but through the daily newspapers and the Sunday editions which come into millions of homes.

Granite or limestone masonry, well dressed, weighs 165 lbs. per cubic foot; mortar rubble eighs 154 lbs., dry rubble 138 lbs., and well dressed sandstone masonry 144 lbs.

The Science of Cost Keeping and Management

By F. A. Barnes*

THERE are, as you all know, two general methods of carrying on work, viz., by contract and by day labor. The engineer designs and lays out the work in both instances, but in the first case his supervision of actual performance is limited to the enforcement of the contract and specifications, while in the second he has direct charge. Theoretically, therefore, the second method saves the contractor's profit and should be the more economical, but, in practice, human nature must be taken into account and we find that the engineer, even though he be as competent as the contractor, is usually not as efficient, probably because he is spending the money of others, while the contractor is practically spending his own, or, at least, is directly interested in having as much as possible left for profit. The truth of the above statement is generally admitted and was recognized by the court in the case of O'Brien vs. Mayor of New York, when it said in its decision: "There is no spur like self-interest in business enterprises, and it may be regarded as certain that the contractor will always take care of his own interest so far as possible. This is natural and proper, and no fault can be or is found with such a fact. But how far the officers or employees who represent the general public or the corporation which is building the work can be depended upon for steady, earnest, zealous, and able attention to the public interest is always a matter, to say the least, of some doubt." A careful analysis of the costs in cases where good showings are claimed to have been made with day labor often reveals the fact that some charges, such as plant repairs and depreciation or overhead expenses, have been omitted entirely from consideration.

Of course, under the day labor system, the party having the work done has better control of it and can more easily make changes as the job progresses, especially as compared with the ordinary lump-sum contract; but his risks are increased, even though liability for accidents to employees and the public is covered by insurance, as is now usually the case. It is principally, however, because contract work is usually cheaper, as pointed out in the preceding paragraph, that most highway work is now and probably will continue to be done under the contract system, and this fact may lead some of you to wonder if it is worth while for the engineer to interest himself in cost keeping and management. In my opinion, this query should bring forth a most emphatic answer in the affirmative, for the following reasons:

Importance of Careful Analysis

In the first place, a careful analysis of the job and the method of performing it, which is essential to effective cost keeping, increases one's knowledge of construction work and is of benefit whether one considers costs or not, but, unfortunately, is not likely to be undertaken unless they are considered. Costs of the component parts of the work and of methods of performing them should always be considered together, however, as such investigation will frequently lead to the adoption of changes in plans or methods, or both—such as changes required to adapt the work to the use of labor-saving machinery, etc. Such investigation would also increase the ability of engineers to make accurate estimates, something which would do much to enhance the reputation of our profession. As to management, its laws apply in considerable measure to all human relations, such as those between contractor and engineer, and completely to relations with subordinates; and no one can reasonably expect to rise to the higher and more lucrative executive positions without some knowledge of such matters. Hence it is my firm belief that a study of cost keeping and management adds to one's value to his employer and to the public by increasing his ability to design economic works and to erect the same at minimum cost, and that such study is absolutely essential if engineering is to justify the definition sometimes given it—"The art of making a dollar earn the most interest."

Cost Keeping Defined

The first topic which I shall take up is cost keeping, which has been roughly defined as the process of determining where your money goes and what you get for it. That is, it involves the determination of output as well as of costs. Even this rough definition is too precise to cover the practice of a contractor, whose testimony I heard in a case in New York City some years ago. He explained that he kept no books. If there was anything left at the end of the job, he put it in the bank; if there was a loss, he drew a cheque for it. Such methods can flourish, of course, only in fields where abnormal profits usually obtain, and are rapidly disappearing. Increasing competition has forced contractors to keep accurate costs, primarily for the purpose of securing high efficiency and hence low costs so as to be able to bid low and secure work to do, and also because of the necessity of knowing costs more accurately when bidding closely in order to avoid loss. That is, the two principal purposes of cost keeping are:

(1) To measure and increase efficiency.
(2) To secure data for making estimates.

To accomplish these purposes, all the factors of cost, viz., labor, materials, plant charges, supplies and overhead expenses, must be considered, and such matters as excessive use of materials or supplies, inefficiency of labor or supervision, lost time due to breakdowns or lack of co-ordination, and irregularities due to dishonesty (padded pay rolls) or carelessness show up at once in the data obtained and may be corrected immediately. The cost of supervision can be reduced quite frequently since the report card with its accurate data on output is a better spur than the presence of a foreman who has to judge from appearance only. Cost keeping furnishes accurate data upon which to base changes in plant layout or design and for testing the efficiency of new machines and also naturally leads to the adoption of some system of wage payment which takes into account the efficiency of the employee.

Concerning Forms

I have not taken the trouble to prepare any forms to show you, as they are rather hard to grasp in the limited time available, and the design of forms constitutes an important part of the training of the "analysis man" or cost keeper. One who slavishly copies forms devised by others not only misses this training, but will probably use forms not entirely adapted to his own work, and, even if they are suitable, will not use them as intelligently as if he had devised them himself. It has been said that anyone can devise forms once he knows exactly the data he wishes to secure and hence it will be best to devote our attention to the principles involved rather than to specific examples. A study of existing forms, especially after one has had some experience, has, of course, great value, and the beginner can thus quickly acquire a knowledge of the various space-saving schemes for use where the desired data are very numerous. These schemes may easily be picked up in the technical press.

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*Assistant Professor of Railroad Engineering in Cornell University.

Probably the most diffifficult part of cost keeping is to determine upon the data to be secured, that is, along what lines and how far shall we carry our subdivision of the work? The tendency of beginners is to subdivide too finely, thus materially increasing the cost of securing the data and producing results of no particular value. Hence we should not only keep in mind constantly the two principal purposes of cost keeping, efficiency and estimates, but should carefully weigh the value of each item and satisfy ourselves that data upon it will be worth while before attempting to secure them. In concrete work, for example, it is manifestly futile to attempt to secure data on costs of the various operations involved in cases where the same men are used for all of them and consequently are continually shifting from one to the other.

Classification and Correction of Data

In determining upon the classification, the items of work given in the contract and upon which unit prices may be given, furnish a good starting point and usually form the basis for the primary subdivision. These items are then subdivided in accordance with the operations involved, particularly if different men or different gangs handle the various operations, and their output must be determined in units other than those of the principal items in order to measure their efficiency. In rock excavation, for instance, the efficiency of the drilling gang depends on the number of lineal feet of hole drilled rather than on the number of cubic yards of rock removed. The above considerations or the desirability of co-ordinating the outfit and men, or classes of labor used in a single operation may lead to its subdivision on one of these bases. For example, form work in concrete construction involves the use of carpenters and helpers and the proportion of cost chargeable to each should be determined so that the most economical arrangement may be found. The application of this same principle to the main items, or to the entire job, leads to the discovery of excessive use of materials or supplies, or that cost of supervision is an excessive percentage of the total, etc.

In addition to the determination of the data to be secured and, in fact, during its determination, attention must also be given to the organization to be used in carrying out the work, especially as it affects the method of securing the data, which in turn affects the design of forms. Where the work is concentrated the timekeeper may be charged with the duty of securing data on both output and costs, though he must depend upon the foreman for information as to the times when the shifts in the gangs are made unless he is on the work continuously. Hence it will frequently be best for the foreman to be held directly responsible for such data, his results being checked roughly by information secured by the timekeeper who visits the work at regular intervals. This latter method is necessary in case the work is spread over large areas or considerable distances. In some cases, especially on piece-work, performed by skilled laborers, data on output are most easily secured by having the individual workmen make the original record. This often increases their interest in the work, and takes little time or attention, involving merely counting the pieces of finished work or punching a tally card as each piece is completed.

On other work output is usually more difficult to determine, involving measurement of lengths, areas, or volumes, but with the aid of the engineer's station marks, lengths are easily found and frequently areas and volumes are direct functions of the length and may be computed in the office. Sometimes volumes are determined from the number of loads handled, but care must be taken to secure fairly uniform loading and to use a proper allowance for change in volume of the material. Again, so-called functional units are used, as in estimating the number of cubic yards of concrete laid in a day from the number of bags or barrels of cement used, etc. The two methods last given, or in fact any approximate method, should be checked by actual measurement at frequent intervals, but cases are rare where complicated measurements are necessary daily. Quantities of materials and supplies used are similarly treated.

Utilizing the Data

Having now determined upon the data to be secured in addition to the pay roll data and the method of securing them, units to be used, etc., the designer of forms must finally consider the accounting system or method of working up the data and utilizing them, as the forms must give the data in shape for immediate and convenient use. Many organizations spend considerable money on the collection of data, but fail to work them up in time to be of service. Simplicity and accuracy should be the keynotes of both cost keeping and accounting systems which should fit into each other. In general, the field records should be favored in the matter of simplicity and all computations and combining of reports should be done in the office. Forms may be simplified, of course, by requiring a number of different men to report and each man's interest may be enhanced thereby, but filling out even a simple report takes time and attention which might often better be devoted strictly to the work and hence I believe the tendency to make the timekeeper responsible for most of the reporting to be a salutary one. The accuracy of reports may sometimes be checked by requiring two men to report on the same thing and it is always roughly apparent from the results secured.

It is, of course, not essential that actual costs be used in studying efficiency, in fact, costs in man-days, machine-days, or in dollars and cents on the basis of assumed standard prices must be used in comparing the results on different jobs, and even then one must be sure that the conditions are similar before jumping at conclusions of relative efficiency. The same methods apply to the combinations of the elements of cost necessary to make up an estimate, that is, since we have amounts of labor, supplies and materials, plant charges, etc., in detail for each part of the operations making up the main contract items, we may apply any prices we choose. It is only in this way that an accurate estimate for a particular case may be obtained. I believe, however, that the accuracy of estimates would be increased by alloting more items and by avoiding the common tendency to throw all supervision and even plant and tool charges into general expenses. Supervision exercised by foreman and even by the contractor himself could frequently be allotted to the various items of work, and there is no reason why the cost of a shovel exclusively used for concrete work should appear in the general charge account. In order to obtain true costs, every possible element should be included in the cost of the item and as little as possible left for overhead or general charges.

Allowance for Depreciation of Plant

An item particularly difficult to determine is the proper allowance for depreciation of plant, also whether heavy repairs should be charged against the job on which they are made even though the necessity for them was largely due to previous work and their benefits extend to subsequent jobs. There are many methods of handling these questions, but I believe the most accurate one is to make an appraisal of the plant at the beginning of the work and as often thereafter as may be necessary for cost keeping purposes. This appraisal should be made by an expert in plant values and the value assigned should be the estimated value, f.o.b. at the nearest probable market.

In connection with the use of costs, the cost chart or graph of unit costs is very valuable as it shows at a glance just how the costs are running; it may also serve to check up the reports due each day if a curve is plotted for each report. Another most useful device is the progress chart, on which a schedule of the work, or items thereof, is laid off with corresponding quantities, percentages, and prices. As the work progresses, actual dates, quantities, percentages, and prices are also plotted so that one has a direct comparison of actual results with the estimate and can predict the probable outcome of the job at any time. I wish to emphasize again the necessity of keeping all these records strictly up to date; it is of no value to find that costs are running high unless it is discovered immediately and the remedy applied before the job has long continued in an inefficient way. There are other minor records, such as the foreman's diary, history and sketches of the work, etc., which should always be included with cost data so that the exact conditions under which the costs were obtained may be known.

The Art of Management

Now taking up the subject of management, I fully agree with Mr. Moore that there are no ten, twelve or twenty principles involved and the management is and always will be an art rather than a science, but many of the principles which have been put forth during the last few years are of value to those who desire to make progress in this art. In my opinion the most important of all these principles is what Mr. Harrington Emerson calls the "Fair Deal" in his book on the Twelve Principles of Efficiency. In fact, I believe it essential that the spirit of fairness permeate every thought and action of the manager if he would be most successful, and the man who takes up a study of management with the sole purpose of getting more work out of his men without giving them and benefit in return defeats his own purpose. Spying upon men to determine whether they are doing good work or not is, I believe, incompatible with the spirit of fairness. Men will work and work hard for the "boss" who is square with them, not, of course, in entire disregard of other factors, but sometimes nearly so.

Next to fairness, in its effect at least, I would put what is sometimes called the law of proportionate reward; that is, pay should vary with output. Strictly interpreted, this means payment for services on a piece-rate basis, which is practically impossible in most civil engineering construction and which has been abandoned by many of our best industrial concerns (where it may be more easily applied). The piece-rate system leads to excessive speeding up and inferior output and does not identify the interests of employer and employee as is attempted by some of the later bonus systems. Bonus systems, especially for gangs, could be applied in civil engineering construction more often than they are and no doubt would increase efficiency. Coupled with this law of proportionate reward is the rule that the reward should be prompt, especially with the unskilled laborer whose imagination is not usually sufficient to furnish continued incentive to increased effort unless he receives the reward at frequent intervals.

Another law of management is that of the subdivision of duties which means, of course, simply carrying the familiar law of subdivision of labor into the organization. Men have different capacities and abilities and care should be taken to observe these in assigning them to work, since they will not only take greater interest in doing work for which their talents adapt them, but will also accomplish more along those lines. Closely allied to this law is the rule that the planning of work should be divorced from the performance. Much money is lost by throwing the burden of planning the work on the foreman, both because he is often not competent to plan and because his whole attention should be devoted to handling the gang.

The Law of Co-ordination

Then there is the law of co-ordination, which is that each element of plant and each gang should be kept working to its full capacity. That is, they should be properly co-ordinated so that no gang will have to wait for any other gang or machine, or for supplies or materials. The time of arrival of supplies and materials must therefore be properly scheduled and the capacity of elements of the plant and of gangs adapted to the work of the others.

Another law of management, if efficiency is to be measured closely by means of a cost keeping system, is that the men or gangs must work under standard conditions. Obviously, it is unfair to compare outputs unless the conditions under which they were obtained are similar.

The law of educational supervision increases efficiency by standardizing practice and also reduces the amount and cost of supervision. Men can accomplish more if trained to do their work in accordance with a standard method, especially if that method is the result of a study of the best methods of accomplishing the desired results, as it should be. Even an individual can accomplish little if he is continually changing methods, and such practice is much more demoralizing to an organization. The instruction books issued by the State Highway Department furnish examples of the application of this law and the reasons for it are well stated therein. Many of our industrial concerns also have elaborate systems of educational supervision.

Executive and Subordinates

In addition to the above laws of management, the executive should remember that he is employed as a manager to handle the big questions and hence should leave the petty details to his subordinates. A good rule is to never handle matters that a subordinate can handle as well, and in cases of doubt throw the responsibility on the subordinate. This will add to his value and relieve the manager for larger affairs. In other words, trust your subordinates and do not continually interfere with them, but leave them to their own resources and hold them responsible for results. Too many managers think themselves indispensable until an enforced absence opens their eyes to the fact that things get on as well or better in their absence than when they are continually present. Another fact to remember is that too close contact with a job frequently causes one to lose his perspective and very often the man who visits the work only occasionally is able to point out defects which have entirely escaped the attention of the man who "lives" on the job. This is the service you should render your subordinates and you are more likely to be able to render it if you hold yourself aloof from the petty details of the work. Furthermore, always respect the authority of your superintendents and foremen and never go "over their heads" and deal directly with their subordinates; nothing will so quickly destroy discipline.

The above are the principal laws of management, but the observance of some other rules will assist in securing results at minimum cost. One of these calls for the reduction of the labor element, partly on account of its high cost per unit of work accomplished and partly because of the uncertainty in its price and efficiency. The cost and output of a machine can be determined much more accurately. Hence there is a decided tendency toward the greater use of machinery and new ones are being devised daily, with the result that the labor element in many lines of work is becoming less and less. Machines must be closely watched, however, to avoid loss of time due to break-downs, especially where the operation of the rest of the plant depends on their being kept at work. Parts liable to break should be kept on hand, ready for instant use, and machines should be repaired outside of hours in so far as possible. This scheme was carried out on the Panama Canal where the break-down of a shovel would throw the whole scheme of operation out of gear. Traveling machine-shops, capable of making heavy repairs to shovels, were sent over the work each night and break-downs during working hours were practically unknown. Lost time may also result from lack of co-ordination and classifying the causes often points the way to the remedy.

A consideration of the number of foot-pounds of work involved in an operation, i.e., looking at it from the standpoint of mechanics, would often indicate a way of reducing this work, such as using rollers to move heavy loads, etc. Low-priced men should always be employed to do the manual labor and sufficient helpers should always be supplied to keep skilled men at work on operations involving the use of their skill. Dead loads should be reduced as much as is consistent with safety and may sometimes be balanced by counterweighting.

The ratio of overhead expenses may often be reduced by speeding up the work, or sometimes it will even be desirable to resort to night shifts for this purpose. As a rule, however, direct costs would increase and it would not pay to work night shifts unless the time limit is very short.

Finally, it should be noted that our whole purpose is to make the sum of the elements of cost a minimum and hence we should not allow ourselves to be misled by the contemplation of a single element. An expensive plant would increase the unit cost for plant charges, but would decrease the unit cost for direct charges and might also decrease overhead charges—both directly and by decreasing time of construction. Hence one must work out all the elements of cost for each and compare their sums before deciding the matter. Once it is decided, however, and during construction, every effort should be made to reduce each element of cost, and in this it will be desirable to determine what percentage each element is of the total cost and devote one's attention to the larger elements first, as a proportionate reduction in the smaller items would be much less important.

Effect of Contracts and Specifications

Now just a few words as to the effect of contracts and specifications and the attitude of the engineer on costs, though some good citizens of New York State will deem it entirely unnecessary to advise greater cooperation between engineer and contractor. Contracts originated from the necessity of forcing men to do as they agreed, that is, because some men would not keep their word, means had to be devised of making them do so. I fear some of this old spirit permeates our present contracts and is responsible for some of the unfairness in them. On the other hand, a contract assumes a perfect agreement between the two parties to do or not to do a certain thing, and if that thing is indefinite, how can there be a real meeting of the minds? That the subject matter of many contracts where so much discretion is given the engineer, is indefinite will be granted by any reasonable person. I have not time to give you illustrations—you all know of them. I want to point out, however, the effect of unfair provisions and of arbitrary and unjust action on the part of the engineer upon the cost of contract work by citing the example of government work. Mr. King, of the bar of the Court of Claims, speaking before the Government Contractors' Association, told of being present when settlement was made on a large government contract. The contractor remarked, "The next time I work for the government, I will get higher prices." The engineer officer replied, "It will be ten years before you get any more work from the government." "Why?" asked the contractor. "Well," said the engineer officer, "because it will take about that time before the rest of the contractors realize that they must bid higher prices on government work."

On a government contract, not long ago, there were no bids received while thirty-six contractors bid on a small sewer job at about the same time. And it is true that in certain departments of the government, there are only a few contractors who are willing to put their pocketbooks in the hands of the engineer officers and take chances on having something left when they resume control. So there is no question in my mind but that the contract and specifications and the attitude of the man who enforces them ultimately affect contract prices. Furthermore, I believe the men who write such contracts and specifications or who assume such unfair and arbitrary positions are less competent than those who make poor designs and they certainly waste more of the public money. I do not mean to say, of course, that the engineer should put himself into the hands of the contractor, but there should be a real agreement on a definite proposition and it should be carried out with fairness and justice on the part of both parties. There are sufficient uncertainties in construction work without increasing them unnecessarily and compelling the contractor to also be a gambler.

One other important matter affecting costs is now being considered in this country, and it should receive our aid. I refer to the elimination of the large economic loss involved in having ten or more contractors spend time and money in estimating a job when only one of them can get the work, by having the estimate made once only by a quantity surveyor, who is employed by the owner, just as the engineer is now employed. They have had quantity surveyors in England for years, but we are only just waking up to the saving which could be made in this way.

Damp Walls

THE architect has at times to meet and overcome defects caused by dampness in walls. The first matter is to determine the cause. If this be removed the remaining trouble may be or may not be left to time, and the decorator. If the whole cause of the trouble, says The Salon, be simply moisture, it will dry out after its supply is cut off.

Among the most fertile sources of this simple kind of dampness in walls above ground are faulty roof gutters, leaky water or sewer pipes, and ineffective surface drainage. In rooms below ground surface the trouble may arise from any of the above causes or from subterranean springs or water-bearing earth strata. If practicable the outer face of the wall should be uncovered and a surface damp course laid against the wall, consisting either of some waterproof material, or a belt of broken stone or pebbles, with a properly formed drain at its foot. If this be not practicable it may be necessary to line the wall inside with lath and plaster fixed on battens plugged to the wall. Where it is possible to induce a current of air to pass up between the vertical battens, that is, between the laths and the damp wall, the moisture is to a large extent removed and a fairly satisfactory remedy achieved. Sometimes a layer of rich cement is floated on the inner surface of the wall after the face has been properly prepared.

Sewage used for Flushing

A flush tank system in which the sewage itself is used for flushing was described by Isaac Shone, the inventor of the Shone compressed-air ejector for handling sewage, at the annual meeting of the Institution of Municipal and County Engineers of Great Britain. Mr. Shone, who is nearly eighty years of age, has developed this flush tank system to eliminate the disconnecting trap commonly required in British plumbing practice between the soil pipe system and the public sewer. The flush tank is a closed cast-iron chamber having a capacity of a dozen to twenty gallons. The sewage discharges into it until it is full, when it automatically empties itself by siphon action. Mr. Shone intends this apparatus, according to the description in his paper, for use on combined sewer systems where the rain water from the roofs as well as the house sewage is discharged into the sewer. With the frequent rainfall in the humid climate of England, frequent discharge and consequent flushing of the lateral sewer would be much more effectively secured than would be possible where the separate system of sewage was in use or in a climate where long periods of drought occur.

Stresses in Railway Track

Stresses in railway track under passing trains have been investigated by Mr. J. T. Williams, professor of railway engineering, University of Kansas, and are described in a paper in the "Railway-Age Gazette." The apparatus used consisted of a recording instrument which measured the deflection of the track and Berry strain gages for measuring the stresses in the rails. Tests were made by senior students in the Department of Railway Engineering under the direction of Professor Williams, and measurements were made both on a main-line tangent where trains passed at full speed, on a 30-deg. curve, and on a tangent yard track near a station. Some of the important results obtained by the experiments are as follows: Stresses in the end of the rail were 25 per cent. greater than at the middle; the end of a rail at a joint is subject to intense vibration resembling that of a tuning fork, so that it was impossible to attach strain gages to the rail. Professor Williams thinks that these vibrations account to some extent for the crushing of angle bars. Freight cars cause fully as high stresses as passenger coaches, notwithstanding the greater wheel loads of the latter. Ther eason is thought to be the crude construction and condition of freight-car rolling stock. Flat spots on wheels increased the stresses 50 to 100 per cent. Vibrations in the speed of a train had no noticeable effect on the tresses. Stresses measured in the head of the rail averaged from 6000 to 10,000 lb. per sq. in. The maximum deflection of the track on stone ballast was about 0.3 in.

Cleaning Glazed Terra Cotta Ornaments

A painter in Pennsylvania desirous of ascertaining how to clean white glazed terra cotta ornaments on the exterior of a building which had been badly stained by smoke wrote to the Painters' Magazine for the desired information and the following suggestions were offered in reply:

"To remove the smoke make a stout lather of soap and water and add some ammonia, and apply this to the ornaments with a soft brush. Let it remain for a little while, but before it becomes dry brush it over the whole surface with a good scrubbing brush, taking care to get into the figures at every angle, then sponge off with clean water. If the smoke stains are obstinate, the addition of finely powdered pumice to the lather and good brushing will remove them. Other stains may be removed by the use of coal-tar benzol or pure spirits of turpentine on a rough cloth.

"When using pumice it is necessary to have the finest grade, known as flour of pumice, to keep the glazed surface from being scratched or dull the lustre of the glaze."

The expansive force of steam is nearly inversely as the volume, thus, if steam at 15-pound pressure occupies 1c. ft., the same quantity at 30-pound pressure would only occupy about ½c. ft. It contains about 5½ times as much heat as 1 pound good coal, evaporated 9 pounds water which has been raised to 212 degrees. Consumption of coal per indicated horsepower per hour in first class triple expansion surface condensing engines, about 1½ pounds in double expansion, from 1¾ to 2 pounds in single cylinder condensing 2½ to 3 pounds, in locomotives 2½ pounds, and in high-pressure non-condensing simple engines three to four pounds.

LETTERS

Editor, Contract Record:

I was interested in the article on "Refuse Incinerator Guarantees Too Strict for Practical Fulfilment" published in the July issue of The Contract Record and Engineering Review. In this article the writer in the Engineering Record is quoted as saying, "The decision of city officials in Atlanta, Ga., and San Francisco, Cal., to reject high-temperature incinerators, because of the failure of the plants to fulfil certain guarantees under test, has brought the character of the specifications into question."

The specifications for the cities of Westmount, Que., Brighton, N. Y., Milwaukee, Wis., San Francisco, Cal., Atlanta, Ga., and Toronto, Ont., appear to have been drawn up by engineers or officials who fully understood what should be accomplished in a city incinerator. These engineers, knowing the different makes that have been installed throughout Canada and the United States, must have known that these conditions should be fulfilled in a high-class incinerator.

I am at a loss to understand how any engineer could get the idea that any city asking for tenders according to these specifications could be asking too much, and I should like to know how any city could make a mistake in asking for proposals according to the specifications.

Now the first essential is "that no nuisance be created during its ordinary operation of the plant," the second, "that no odors or obnoxious gases, dust or smoke be allowed to escape from the building or chimney," and the third, "that the residuum from the furnaces be thoroughly burned, hard and free from organic matter." What would be the advantage of a city spending thousands of dollars if the furnace is going to create a nuisance in its ordinary operation, and emit noxious odors and gases, dust and smoke, from the building and chimney, and only partly burn the material Would it not be less expensive to enclose an open dump and erect a chimney and connect them together? Is there any engineer or other official who can put up an argument that these conditions should be allowed?

Now the other respects in which the Atlanta, Ga., plant is criticized are in regard to "rate of evaporation," "rate of combustion," and "cost of labor per ton." Is it reasonable to suppose that, with a view to being the lowest bidder, a contractor would make the statements "high in evaporation and combustion" and "low in labor cost per ton?" As this firm claims to have placed quite a number of first-class incinerators in various cities, how can the specifications of just two be selected as being unworkable? One is disposed to ask whether the other plants were properly tested.

It is gratifying to know that there are some engineers and city officials with enough backbone to make the contractors live up to the specifications before receiving the city's money.

This firm, according to the catalogue, would appear to have had great success in Europe. But America is not Europe, and the garbage here is entirely different. In Europe the moisture contained in the garbage is only ten per cent., while on this continent it runs as high as ninety per cent., so that what might be a first-class furnace there would not meet the requirements here. In Atlanta, Ga., the city had an incinerator operating successfully in the same location as the new one for eight years, at a cost of twenty-five cents a ton for labor and fuel. This showed the officials what could be accomplished, so why should they accept a furnace that could not fulfil the specifications?

The method of burning the garbage in this make of furnace is not in accordance with the modern practice of firing. The moist material should not be fed on to a dead grate, and have the heat of the arch above reflected, with the force draft forcing air through the material the opposite way; the material should be held in suspension over the final burning grate until the moisture is thoroughly evaporated, and then fed on to the grate in a half-burned state. The fire should always be a bright burning fire, where the material from the suspended grate should be used as fuel. In this way there are no gases to be destroyed.

The material should be held in suspension so that eighty-five per cent. of the under surface is directly exposed to the elements of the fire from the final burning grate, and there should always be passage around the material so as to ensure an outlet for the products of combustion.

Provision should be made for a means of removing the ashes and clinker from the final burning grate to the ash pit without drawing them out of the furnace. If the doors are kept closed no dust or smoke will be emitted.

The writer of the article under discussion says that it is impossible to build a furnace to comply with these specifications. As a builder of incinerators, I contend that this is an injustice to the manufacturers in this trade. More, it tends to mislead city engineers and city officials generally into thinking that it is impossible to get a furnace that is not a nuisance in every sense of the word.

In conclusion, I can only say that an incinerator should be built to receive the material directly from the wagons, and designed to hold it in suspension until the moisture is thoroughly evaporated, when the material should be fed on to the final burning grate in a half-burned state, and then thoroughly consumed and afterwards fed into the ash pit without being drawn out of the furnace, all the gases being subjected to a high heat and washed before entering the chimney. If an incinerator meets these requirements our city officials will have a plant that fulfils all their requirements to the letter.

Yours truly,

F. L. DECARIE

Pro Patria

IN the honour roll of men formerly identified with the constructional industries, and now serving with the colours, we recall the following officers: Lieut.-Col. William Hendrie, Hamilton Bridge Works Company. Limited, Hamilton, Ont.; Lieut.-Col. R. W. Patterson, Winnipeg Paint and Glass Company, Limited, Winnipeg; Lieut.-Col. J. A. Currie, M.P., Imperial Steel and Wire Company, Limited, Collingwood, Ont.; Lieut.-Col. J. F. L. Embury, Canadian Lock Joint Pipe Company, Regina, Sask.; Major Pelly, Steel and Radiation, Limited, Toronto; Major J. R. L. Parsons, Canadian Lock Joint Pipe Company, Regina, Sask.; Major T. C. Irving, Moffat-Irving Company, Toronto; Major P. R. Hanson, Dunlop Tyre and Rubber Goods Company, Limited, Montreal; Capt. E. E. Williams, Dunlop Tyre and Rubber Goods Compannny, Limited, London, Ont.; Capt. Trumbull Warren, Gutta Percha and Rubber Company, Limited, Toronto (killed in action); Capt. J. T. Duguid, Imperial Steel and Wire Company, Limited, Collingwood, Ont.; Capt. C. R. Crowe, Crowe's Iron Works, Guelph, Ont.; Capt. F. R. Newman, Canadian Fairbanks-Morse Company, Limited, Toronto; Capt. Alexander Campbell, Campbell Steel and Iron Works, Limited, Ottawa (died of illness); Lieut. K. E. Drinkwater, A. B. See Electric Elevator Company of Canada, Limited, Montreal; Lieut. T. E. Ryder, Canadian Fairbanks-Morse Company, Limited, St. John, N. B.; Lieut. G. H. Saltmarsh, Metallic Roofing Company, Winnipeg; Lieut.

William Martin, Jr., Manitoba Gypsum Company, Winnipeg; Lieut. Lacey, Steel and Radiation, Limited, Toronto; Lieut. Garret, Steel and Radiation, Limited, Toronto; Lieut. Ian Hendrie, Hamilton Bridge Works, Limited, Hamilton, Ont.; and Lieut. H. C. Hatch, Canada Steel Goods Company, Limited, Hamilton, Ont.

A Well Known Consulting Engineer

As already announced in our columns, Mr. R. O. Wynne-Roberts has discontinued practising as a consulting engineer at Regina. He has now opened an office at 310 Temple Building, Bay Street, Toronto. As he has contributed frequently to our columns, his name, at any rate, will be familiar to our readers.

Mr. Wynne-Roberts' experience in municipal engineering and administration extends back over thirty-two years, when at the age of eighteen he was appointed Assistant Town Engineer of a well-known holiday resort in North Wales, and made responsible for practically all the engineering work carried on by the municipal authority. These included water-works, gas-works, sewers and roads, both new construction and ordinary maintenance, employing about 150 men. This appointment he held for seven years.

Mr. R. O. Wynne-Roberts.

During these thirty-two years Mr. Wynne-Roberts has been associated with almost every kind of municipal undertaking in Great Britain, South Africa, and Canada.

Apart from important work he had in hand as City and Water Engineer of Cape Town during the years 1898 to 1907, such as water-works, street improvement, etc., employing about 2,500 men, Mr. Wynne-Roberts had to undertake the first part of the work of stamping out bubonic plague, which had broken out during the Boer War. He was a Captain of the Town Guard, and also carried out the bulk of the work of street decorating and preparing for the reception of Their Majesties King George and Queen Mary—then the Duke and Duchess of York.

Returning to London (Eng.), in 1907, he opened an office in Victoria Street, Westminster, and among the works undertaken by him were two arbitrations. In the first case there were four different authorities, one of whom had planned to construct a street railway some miles in length on a street which ran through three separate districts. Disputes arose among the four authorities as to the details of construction, and finally the British Board of Trade appointed Mr. Wynne-Roberts sole arbitrator to settle the points of disagreement. It is interesting to note that one of the Counsels appearing before Mr. Wynne-Roberts was Lord Robert Cecil, now a member of the British Government. There were five prominent Counsels engaged to represent the various authorities, and about forty witnesses were examined. The arbitration lasted over nine days, and the evidence was recorded and printed verbatim.

Mr. Wynne-Roberts' experience in Canada has been an interesting one. In 1911 he was engaged by Mr. A. J. McPherson, then City Commissioner of Regina, now Chairman of the Saskatchewan Local Government Board, to investigate and report on the question of augmenting the supply of water. Mr. L. A. Hornton succeeded Mr. McPherson as City Works Commissioner, and it was with him that Mr. Wynne-Roberts was associated as Consulting Engineer in connection with the many schemes that were under consideration from time to time by the city authorities.

Mainly Constructional

The assets of Messrs. Cote et Frere, contractors, Quebec City, are to be sold on August 19th.

W. H. Dance & Company is the name of a new plumbing and steam-fitting firm registered at Montreal.

The George Frid Brick Company, Limited, is a new Hamilton, Ont., firm which has obtained a charter.

Among the public improvements which are now being considered by the City Council of Victoria, B. C., is the erection of an abattoir at a cost of $20,000.

Mr. George D. Mackie, City Engineer, Commissioner of the City of Moose Jaw, has been elected an associate member of the Canadian Society of Civil Engineers.

Mr. C. H. Mathewson, Resident Engineer on the Toronto Harbor Improvement project for the Canadian Government, has been appointed District Engineer for the Department of Public Works at Winnipeg.

A sign of the times is the fitting out of a shell factory at Goderich, Ont., by the Doty Engine Company, Limited. At the time of writing we are informed that the machinery for the equipment of this plant is to be purchased at once.

The Dominion Bridge Company, Lachine, are the contractors for the superstructure of a bridge which is being erected over the Petitcodiac River at Moncton, N. B. The work is being done under the supervision of Mr. A. R. Wetmore, Provincial Engineer of Public Works.

Exterior work is progressing rapidly in the erection of the First Church of Christ Scientist at Winnipeg, for which the Fort Garry Construction Company are the general contractors. The architects of this building are Messrs. Gordon & Over, of Winnipeg. The steel work is being done by the Vulcan Iron Works, Limited.

Rapid progress is being made on the Twenty-Fifth Street bridge at Saskatoon, Sask., under the direction of Mr. Fred. Saynor, the Government Resident Engineer. The upper superstructure of two of the arches is now completed, the floor slab is on, and all that has to be done is to lay the 8-inch sub-base and a two-inch asphalt wearing surface.

The Brown Construction Company, who have the general contract for the erection of the drill hall at North Winnipeg—a job costing over $100,000—have made good progress, and the interior work is now well under way. The building is two storeys high, with basement, and is of reinforced concrete, steel and brick construction. Mr. H. E. Matthews is the resident architect.

The erection of station buildings on the line of the Canadian Northern Railway between Port Mann, on the Fraser, and Hope Mountains, is being pushed with great vigor. Already the buildings at Langley, Matsqui, Glen Valley, Sumas, St. Elmo and Rosedale are completed, and at Boston Bar the material for a five-stall round-house, a 40,000 gallon tank, a turn-table and freight sidings is being assembled. The Division yards will be located at the latter point.

At a meeting of the Toronto Board of Control the other day, discussion centred around the advisability of making public a report on the Morley Avenue sewage disposal plant prepared by Mr. R. C. Harris, the Works Commissioner, and Dr. Hastings, M. H. O. In the course of the discussion the Mayor, Mr. Church, stated that the system would have to be rebuilt at a cost of between four and five million dollars. He did not see why this fact should be witheld from the public. Meanwhile the report remains in the hands of the Board.

In an endeavor to smooth away the difficulties which have arisen occasionally in connection with the period of the time during which contractors should be responsible for the maintenance of pavements and concrete sidewalks, the City Commissioners of Regina, Sask., are asking the Council to set a definite period from which responsibility shall commence. It is suggested that as the city is frequently unable to finish contracts the same year as they are commenced, the time from which maintenance shall commence shall be from the time the City Engineer issues the final certificate accepting the work on each contract. A recommendation to this effect is being brought before the next meeting of the City Council.

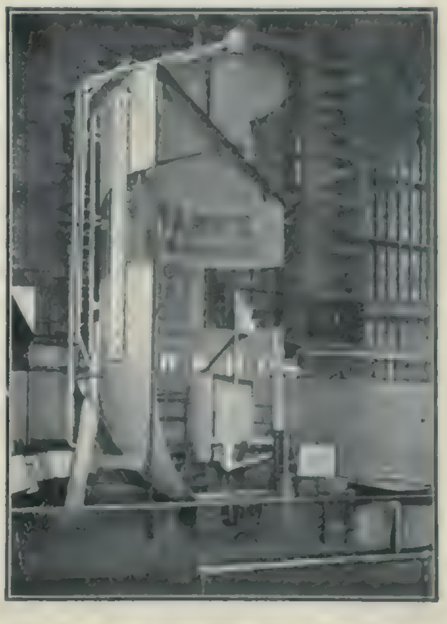
The annual report of Steel and Radiation Ltd., just issued, is of particular interest from the standpoint of the position the company is in to take advantage of war orders, rather than the showing it was able to make under the exceptional conditions that prevailed during the past year. It is announced that the contracts which the company has obtained from the Shell Committee at Ottawa are sufficient to keep the entire plants operating to full capacity, so that to a great measure this will offset the falling off in general construction work which calls for so much of the company's products. Even under the adverse conditions that prevailed however, the company was able to meet its entire bond interest and to show profits of $13,797 over and above the amount required.

Pending the furnishing of more information, the Vancouver city council has refused a charter to the Vancouver Terminal Railway Company, which proposes to build a line into the city in connection with a big dock development scheme at the mouth of the Fraser River. Mr. J. B. Noble Solicitor for the company, and one of the Directors, said that only with the assurance that the railway would be constructed could the money be raised to finance the entire $20,000,000 scheme, on which $1,250,000 had already been expended in securing land options. The railway which is to enter the city through a five-mile tunnel, will cost $7,000,000 or $1,000,000 a mile. Mr. Noble promised that construction would start six months after the issuing of the charter and would be completed within three years.

An installation of Gent electric clocks, which are manufactured by the well-known firm of Gent & Company, Leicester, England, is to be made at once in the Gutta Percha Building, 47 Yonge Street, Toronto, by Wm. Ashall, 442 Sherbourne Street, Toronto, who is that company's sole representative in Ontario. These Gent clocks are to replace another system of electric clocks and will include the tower clocks as well as those in the offices. Mr. Ashall has installed Gent electric clocks in the Dominion Bank's buildings at the corner of King and Yonge Streets, Toronto, and Windsor; in the Mutual Life Insurance Company's building at Berlin, and in the Allan Steamship Company's offices on King Street, Toronto. This system was installed some time ago in the Dominion Bank's building at Windsor. All have given perfect satisfaction.

An Unusual Exhibit

Among the many original exhibits at the Panama Pacific Exposition, that of the Pittsburgh-Des Moines Steel Company commands attention. As shown herewith, it consists of a vertical half section of one of their 50,000 gallon elevated steel tanks, mounted on short posts, and so arranged that all the fittings, such as expansion joint, riser pipe, mercury gauge,



Pittsburgh-Des Moines Steel Company's novel exhibit at the Panama-Pacific Exposition.

One of the large steel tanks erected by the Pittsburgh Des Moines Steel Co.

heater, balcony ladders, may all be visited at close range, and their details and the workmanship of the structure in general carefully inspected.

This method of exhibition has the advantage over pictures and models that all the construction details can be seen in full size, as they are actually fabricated and erected in practice. Those technically inclined can satisfy themselves as to the effectiveness of the different valves, gauges and other accessories by actually trying them out.

These tanks are designed for municipal water service, railroad service, fire protection and special purposes. They range in size from the small 10,000 gallon roof tank for sprinklers to structures of over a million gallons capacity for large water systems. The manufacturers of these tanks were awarded the gold medal, the highest award made for this type of structure.

There is also a large United States map on which are affixed pins in the shape of a miniature water tower at each location where a tank has been erected. There are almost one thousand five hundred of these structures scattered throughout the country, besides a number in foreign lands. A large collection of photographs of completed structures supplements the exhibit.

The Jittsburgh-Des Moines Steel Company has offices in Pittsburgh, Pa.; New York City; Des Moines, Ia.; Dallas, Tex., and San Francisco, Cal.

Equipment for Australian Naval Dockyard

THE largest and most comprehensive sets of tender forms, specifications and drawings yet received by the Department of Trade and Commerce are those forwarded by Mr. D. H. Ross, Trade Commissioner at Melbourne, for electrical and other machinery and equipment required for the Commonwealth Naval Dockyard at Cockatoo Island, Sydney, N.S.W. The tender forms may be inspected at the Department of Trade and Commerce, Ottawa. Particulars of the requirements, together with the date the tenders close at Melbourne, are briefly outlined, thus:—

Section A.—Tenders closing October 25, 1915. Three 1,000 K.W.D.C. geared turbine generator sets as per plan, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyor, crane, 1,000 K.W.D.C. geared turbo set, 225 K.W.D.C. generator, rotary balancers, main switchboard and cables, condensers.

Section B.—Tenders closing October 25, 1915. Three 500 K.W. triple expansion reciprocating sets. Two 750 K.V.A. mixed pressure exhaust turbine alternators, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w. reciprocating sets, 750 k.v.a. mixed pressure turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section C.—Tenders closing October 25, 1915. Three 500 K.W. triple expansion reciprocating sets. Two 750 K.W.D.C. mixed pressure exhaust turbine generators, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 K.W.D.C. reciprocating sets, 750 k.w. mixed pressure geared turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section D.—Tenders closing October 25, 1915. Five 600 K.W.D.C. Diesel engine sets, viz., 600 K.W.D.C. Diesel sets, 225 K.W.D.C. Diesel sets, rotary balancers, switchboard and cables.

List of Machine Tools for Engineering Department of Dockyard—Tenders closing October 27, 1915

Machine Shop.—Turbine boring machine, vertical and horizontal planing machine, horizontal boring tapping, studding, drilling and milling machine, horizontal drilling, tapping and studding machine, high speed turbine rotor lathe, shafting lathe, heavy double-ended, heavy duty lathes (2), high class lathe, high speed, high class lathe, high speed, vertical boring mill, vertical turning and boring mill, vertical boring and turning mill, face plate lathe, cylindrical grinding machine, broaching machine, horizontal planing machines (2), horizontal planing machine, horizontal planing machine, slotting machine, vertical shaping machine, shaping machines (2), gear generating machine, bevel gear cutting machine, thread milling machine, band saw, vertical grinder, double headed disc grinder, cylindrical grinder, boring and facing machine, vacuum cleaning plant.

Bross Finishers' Shop.—brass finishers' turret lathe, brass finishers' surfacing and boring lathe, brass finishers' surfacing and boring lathe, duplex cock turning lathe, screw cutting lathe, screw cutting lathe, grinding machine, high speed shaper, boring and facing machine, boring and facing machine, horizontal drilling machine, condenser ferrule making machine, double-headed disc grinders, ribbon grinder, automatic screwing machine.

Tool Shop.—sliding, surfacing and screw cutting lathes, sliding, surfacing and screw cutting lathes, high class horizontal planing machine, universal milling machine, die sinker, high class shaping machine, radial drill, thread milling machine, grinding machine, hydraulic press, hydraulic vertical plate bending machine, hydraulic rivetting machine, hydraulic joggling machine, high speed friction saw, hydraulic portable rivetting machine, manhole cutting machine, large hydraulic press, set rolls, multiple spindle drilling machine.

Bolt Shop.—automatic screwing machine, automatic screwing machine, drop hammer, nut facing machine, multiple head tapping machine, hot press nut machine.

Turbine Shop.—(Blading Room).—packing piece cutting-off machine, blade tipping machine, horizontal multiple-blade drilling machine.

Coppersmith Shop.—pipe screwing machine, pipe screwing machine, pipe screwing machine, pipe bending machine, punching and shearing machine, circular saw, hack saw.

Pattern Shop.—Disc grinder.

Electrical Shop.—3½-inch lathe, 6-inch lathe, pipe-cutting machine, shaping machine, pipe screwing machine, combined wet and dry grinding machine, pouching and shearing machine, radial drilling machine, universal milling machine, coil winding machine, armature coil taping machine, vacuum drying and impregnating plant.

Platers' Shop.—Hydraulic joggling machine, hydraulic manhole punching machine, notching machines (2), double punching machines with side shears, bulb angle and double bar shear and beam bending machine, plate slitting shears, band saw, plate straightening rolls, horizontal drills (2), punching and shearing machine, punching and shearing machine, double tool grinders (4), pneumatic hammer, bevelling machine, hydraulic frame benders (2), punching and shearing machines (3), radial countersink drilling machines (3), bulb angle and double bar shears and beam bending machine, plate slitting shears, horizontal drills (2), band saw, plate bending rolls (1), manhole punch, plate joggling machine, plate flanging machine.

Fitting Shop.—Planing machine, planing machine, slotting machine, double-headed shaping machine, universal miller, high speed sensitive pin drills (2), high speed boring and surfacing machine, high speed boring and surfacing machine, high speed radial drilling machine, high speed radial drilling machine, variable speed combination turret lathe, variable speed hexagon turret lathe, variable speed gap lathe, hollow spindle friction capstan lathe, variable speed hollow spindle flat turret lathe, double grinder, side disc grinder, band saw.

Plumbers' Shop.—Single head pipe screwing machine, single head pipe screwing machine, pipe flange face grinder.

Joiners' Shop.—Automatic knife grinding machine, pendulum saw, Perkins or other hand trimmer, planing machine.

Shipwrights' Shop.—Electric deck planing machine, planing machine, boring machine, steam hammers (2), steam hammer, steam olivers, forge steam hammer.

Tenders should be addressed to the Director of Navy Contracts, Navy Office, Melbourne, Australia. The departure of mails, by which tenders can be submitted within the contract time, from San Francisco and Vancouver, are as follows:—from San Francisco, September 28, due at Melbourne October 19; from Vancouver, September 29, due at Melbourne October 23. There is no duty on naval supplies.

Ottawa's "Leaning Tower"

Several years have gone by since The Contract Record called attention to the sinking of the tower on the Victoria Museum at Ottawa. A number of times we urged that experts be appointed to report on the structure, and that remedial measures be taken at once. Now an announcement comes from Ottawa that the tower is to be taken down entirely, in order to avoid a complete collapse. The Museum building was begun in 1906, and was completed two years afterwards at a cost of nearly one million dollars. Ever since the completion of the building the great square tower which adorns the central front has been breaking away, until now the structure has assumed the outward characteristics—but not the inward virtues—of the Leaning Tower of Pisa. Underpinning has been tried, but the great weight of masonry and the fact that the foundations did not go down to bedrock have made it of no avail. The Public Works Department have been struggling with the problem of bolstering it up, but on the advice of a New York expert engineer it has now been decided that the only solution is to take it down completely and rebuild a firmer foundation. The cost of rebuilding will run into the tens of thousands. Tenders have been called for the demolition.

Iron and Steel Shortages in Great Britain

A Leeds (Eng.) correspondent states that consumers of iron and steel are viewing with much concern the future prospects of securing adequate supplies to meet their requirements. The European war has materially altered the position in this and other allied trades. The munitions of war now being manufactured in Great Britain are absorbing enormous quantities of iron and steel and are thus curtailing the supplies available for commercial purposes. The position in the near future is likely to become more serious, as the Government demands for high tensile and tested steel and other equally needed materail, are rapidly increasing. One local merchant has already communicated with some of the leading manufacturers in Canada, to ascertain what can be obtained from that source, and it would be interesting to learn what Canadian firms may be able to offer in such lines as steel wire rods, copper rods or brass rods for shipment to the United Kingdom.

Fine New Bank for Vancouver

Work has been started on a three-storey bank building for the Merchants' Bank at Granville and Pender streets, Vancouver, which will cost approximately $175,000. It will occupy the 50 feet frontage where the bank's former office stood, and will extend back along Pender street for 104 feet. The main feature of the new building will be the high banking chamber, 30 feet from floor to ceiling. Above that there will be two floors of offices, and the whole structure will be equal in height to five ordinary storeys. The front and side will be composed of cut stone. The main entrance is shown on the plans as being the centre of the Granville street facade, while the entrance to the offices will be on Pender street. The banking chamber will have a novel appearance in the coloring and the counter schemes. Grey will be the color used in the marble work throughout, except the ceiling, which will be finished in Renaissance style. The cages around the tellers' desks will be of as light material as possible. Dull steel instead of brass will be used to carry out the grey color scheme. Safety deposit vaults are shown in the rear, while the main vaults of the bank will be in the basement. All up-to-date devices used in buildings of this kind will be installed, such as oil-burning furnaces and air-purifying apparatus. The plans have been drawn by Somervell & Putnam Ltd., architects, of Vancouver, and the contractors are Purdy & Henderson, Ltd., Vancouver, a well-known firm of builders. The new building will be completed in about a year from date.

Messrs. Joseph T. Ryerson & Son, Chicago, have established an up-to-date new warehouse at Jersey City, from which immediate shipments of iron, steel and machinery will be made for the Canadian trade. The firm has been well known for three-quarters of a century. Each year has witnessed great expansion, and the facilities of the Ryerson plants have been extended until now three groups of warehouses, in New York, Chicago, and St. Louis, serve the steel buyer with everything in iron, steel, and machinery, from the largest structural shape to the smallest cotton

Municipal Improvement at Bathurst, N.B.

PLANS and specifications of a water-works and sewerage scheme for the town of Bathurst, N. B., have been prepared by Mr. T. H. Higginson, engineer, 58 Beaver Hall Hill, Montreal, and the contract has been let to A. R. Clarke & Sons, St. John, N. B., at the price of $130,000. The work comprises the installation of a 350-foot concrete and earth dam, with a 30-foot spillway across Carter's Brook; a power house of fireproof construction on the bank of the brook, with two 150 horse power return tubular boilers, 1,000 gallon underwriters' steam fire pump and a 500-gallon underwriters' steam fire pump. The water from the pumps is to be conveyed across the Nipisiquit Bay through a 10 in. c.i. pipe into the town of Bathurst, a 10-in. pipe carrying the water into Bathurst Village.

In addition, it is intended to install 107 hydrants, 56 shut-off valves, 8 miles of underground piping (including 6, 8 and 10-in. pipe), together with a sewerage system of 6-in. to 20-in. pipe, with outlets provided for each house. As a secondary supply to the water system, there will be a 405,000 gallon steel gravity tank erected in the town of Bathurst, and arranged to automatically connect with the underground piping, thus giving the town reserve storage capacity. The water will be taken from Carter's Brook; an analysis by the Milton Hersey Company, Limited, shows the water to be exceptionally clear, Carter's Brook being entirely fed from springs.

The cast iron pipe to be used throughout the waterworks is Class C, with vitrified tile pipe for the sewerage system. The manholes are to be of concrete, and Robertson gullies are to be installed. Flushing connections for flushing the sewers from the water mains will be provided. A pressure of one hundred pounds will be maintained at all times.

The system has been planned to conform to the latest requirements of the fire underwriters, and a 25 per cent. reduction on all insurable values has been guaranteed as the result of the carrying out of the contract. The work is being supervised by Mr. T. H. Higginson.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Amherstburg, Ont.
The Town Council (Clerk, G. E. Pulford) contemplate paving Dalhousie and Murray Streets here. An estimate of the cost will be laid before the Council soon.

Belleville, Ont.
Tenders will be received until August 26th by the chairman of Public Works, for excavation, concrete base, binder, wearing surface and curb and gutter of a Trinidad Lake asphalt pavement, approximately 5,104 sq. yds. Plans and specifications at office of the engineer, J. Walter Evans. City Clerk, J. Wilfred Holmes. Chairman Public Works, A. C. McPhee.

Burlington, Ont.
Tenders are open and will be received by the Town Council, until August 23rd, for construction of a reinforced gallery and connections for the water-works. Plans and specifications can be obtained from the office of the engineers, Chipman & Power, 204 Mail Building, Toronto. Tenders to be addressed to J. S. Allen, secretary, Town Council, Burlington.

Chatham, Ont.
By-laws have been passed by the Town Council, providing for the construction of reinforced concrete pavements and granolithic sidewalks on various streets. Engineer, F. P. Adams.

Leamington, Ont.
A by-law has been passed authorizing the construction of a pavement 42 ft. wide, from Talbot to Nelson Streets, and 28 ft. wide from Nelson to Concession Streets. Tenders are to be called shortly. Town Councillor, Mr. Smith, Board of Works; Clerk, R. M. Selkirk; Engineer, J. J. Newton, Ouellette Avenue, Windsor.

London, Ont.
The Board of Health has recommended the construction of a new 8-in. sewer on High Street. City Clerk, S. N. Baker; Engineer, H. A. Brazier. Estimated cost, $13,000.

Maryborough Township, Ont.
Tenders are open and will be received by the Township Clerk until 2 p.m., August 21st, for the construction of a $6,000 drain. Engineer, C. D. Bowman, West Montrose; Clerk, W. W. Scott, Moorefield. Plans and specifications at I. R. Clarkes' Drug Store, Moorefield.

New Westminster, B.C.
The City Council contemplate extending the six-inch water-main on Eighth Street from Edinburgh to London Street, and that on Sixth Street from there to First Avenue. Clerk, W. A. Duncan; Engineer, J. W. Blackman.

Niagara Falls, Ont.
Tenders are called and will be received by City Clerk, W. J. Seymour, for the construction of sewers, length 1,800 ft., vitrified tile, size 10 in. Mayor, C. N. Clendening; Engineer, F. J. Anderson, City Hall. Closing date for receipt of tenders August 23rd.

Norwich South Township, Ont.
Tenders will be received until August 21st by the Township Clerk, A. McFarlane, Otterville, Ont., for the construction of 5,000 feet of tile drain and about 1,500 feet of open drain. Specifications at office of the Clerk.

Ottawa, Ont.
Work is to start at once on the construction of a sewer by day labor, at a cost of $6,000. Mayor, N. D. Porter; Engineer, F. C. Askwith.

Sandwich, Ont.
A by-law to spend $12,000 for the opening of Wyandotte Park and cross streets was defeated.

A by-law to appropriate $3,000 for sidewalks was defeated. Town Clerk, E. R. North; Engineer, Owen McKay.

Toronto, Ont.
Commissioner of Works, R. C. Harris, has recommended that a granite block pavement be laid on Yonge Street between Summerhill and Farnham Avenues. Estimated cost, $14,000.

Tenders will be received by the Commissioner of Works, R. C. Harris, City Hall, until August 31st, for the construction of a storm sewer on Dundas Street, Erie Terrace and St. Clair Avenue.

The Commissioner of Works R. C. Harris, City Hall, has recommended to the Board of Control, the construction of new sidewalks on a number of streets, at an estimated value of $5,000, and the laying of asphalt on Beachview Crescent at $7,062, and on Dupont Street at $38,959. He has also recommended the laying of Rocmac macadam on Stibbard Street at an estimate of $3,607. This is to be approved by the Committee of Works.

West Tillbury Township, Ont.
Plans have been drawn for the construction of drains here, at a cost of $3,451. Secretary, S. T. Anderson, Comber; Engineer, J. J. Newman, Quellette Avenue, Windsor.

Weyburn, Sask.
Work is in progress on the construction of the $15,000 sewage disposal plant here. The city is doing the work by day labor. Secretary-Treasurer, Mr. Inwards; Engineer, George Reed.

Wingham, Ont.
The Town Council propose to lay water mains on several streets. Town Clerk, John F. Groves.

Winnipeg, Man.
The Winnipeg Electric Railway Company have been ordered by the Public Utilities Commission to undertake a considerable quantity of underground work in order to prevent electrolysis of watermains, etc. Approximate cost, $300,000.

CONTRACTS AWARDED

Assiniboia, Man.
In connection with the laying of watermains here, contracts have been awarded by the Municipal Council to Gibault Company, Limited, St. Boniface; S. Wiggins, Kirkfield Park P. O., Assiniboia; H. Galbraith, 666 Pine Street, Winnipeg; Dominion Construction Company, 290 Selkirk Avenue, Winnipeg.

Port Colborne, Ont.
Work is to start at once on the construction of from 1¼ to 1½ miles of macadam roadway in the villages of Humberstone and Port Colborne. General contractor, Hagersville Contracting Company, Hagersville, who will furnish own supplies. Estimated cost $5,000. Town Clerk, D. Alair.

Verdun, Que.
In connection with the laying of concrete sidewalks, etc., at an estimated cost of $80,000, the contract has been awarded by the City Council (Clerk, George A. Ward, City Hall) to Warner, Quinlan Asphalt Company, 745 St. Catherine St., Montreal. City Engineer, E. H. Tanner, City Hall.

Windsor, Ont.
The contract in connection with the sewers along Giles Street and Howard Avenue, and Goyeay Street and Aley Street, has been awarded to Merlo & Ray, Tecumseh Road, at an estimated price of $7,292. City Clerk, Stephen Lusted; engineer, M. E. Brian.

Railroads, Bridges and Wharves

Alvinston, Ont.
Work is to start at once on the remodelling of the Michigan Central station here, at a cost of $3,000. The general contractor and foreman is Mr. Fraser, Michigan Central Railway, Alvinston.

Burford Township, Ont.
Tenders on the construction of two concrete and steel bridges are being received by the Township Clerk, F. W. Taylor, R. R. No. 3, Burford.

Dover Township, Ont.
Tenders are called and will be received by the Township Clerk, James Fox, Electric, Ont., until August 21st, for the construction of three concrete and steel bridges over the Big Bear Drain. Engineer, George A. McCubbin, 135 King Street, Chatham.

Etibocoke Township, Ont.
Plans are to be prepared for the erection of a bridge on Concession A opposite Lot 21. Engineer, F. Barber, 57 Adelaide Street E., Toronto. Township Clerk, S. Barrett, Islington.

Niagara Falls, Ont.
Work is now about to start on the building of a naero-car tramway system over the Niagara River at Whirlpool Rapids, by the Niagara Spanish Aero Car Company, Niagara Falls.

Toronto, Ont.
The Works Committee of the City Council have approved two sets of plans for the bridge to be erected in Mount Pleasant. Tenders will be called if plans are approved by the Railway Board. Construction, steel and concrete or concrete only.

CONTRACTS AWARDED

Moncton, N.B.
The general contract for the Bridge Superstructure over Petitcodiac River has been awarded by the Provincial Government Department of Public Works (Minister John Morrissy, Fredericton, N. B.) to Contractors and Engineers, Limited, manager E. R. Reid, Granville Ferry, N.S. Steel-work is by Dominion Bridge Company, Lachine, Que. Provincial Engineer, A. R. Wetmore.

Shawinigan Falls, Que.
In connection with the construction of the bridge over Shawinigan River, the sub-contract for steel work has been let to the Phoenix Bridge Company, 83 Colborne Street, Montreal. The general contractor is O. J. Meunier, 24 Niverville. Three Rivers. The dimensions of the bridge are to be 1 span, 100 ft. long, 19 ft. wide, concrete and steel. Secretary to the Municipal Council, O. J. Meunier.

St. Rose, Que.
Work has been started on the erection of a concrete pillar. General contractors, Plouffe, Legace and Cie, Bord a Plouffe, Que., who will purchase material. Secretary-Treasurer of the Municipal Corporation of St. Rose, Henry Chapleau. Estimated cost $4,000.

Tillsonburg, Ont.
In connection with the erection of the Simcoe Street steel bridge, the Town Council have awarded the following contracts:—steel, J. Hill and Company, Logan Road, Mitchell; cement work, A. L. Oakman and G. A. Thomas, Pearl Street, Tillsonburg. The bridge is to 62 ft. span, 18 ft. roadway with sidewalk in addition. Town Clerk, H. Coomber; Clerk, A. E. Raynes.

Public Buildings, Churches and Schools

Colchester South, Ont.
The erection of a church is contemplated, at a cost of $3,000. Material is to be selected. Owners, St. Marks A. M. E. Zion Church; address the secretary, Colchester South, Harrow, Ont.

Ford City, Ont.
Tenders on alterations and additions to the Roman Catholic Presbytery are being received by G. Jacques and Company, Architects, Boug Block, Windsor.

Halbrite, Sask.
Tenders are open for additions to the school, at a cost of $6,000, and will be received until August 21st, by the architect, J. G. Jarrett, Third Avenue, Weyburn, and the Halbrite School Board.

Joliette, Que.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., August 27th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at offices of the Caretaker, Post Office, Joliette, Que., R. L. Deschamps, Overseer, Montreal Central Post Office, and Department, Ottawa. Specifications at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

St. Louis Guilbert, Man.
Tenders are open and will be received by Secretary-Treasurer, F. O. Sargent, of the Wakefield School District, for the construction of a school, two storeys high, 35 x 46, concrete foundation and brick construction, to cost approximately $6,500. Architect, F. R. Evans, 170 Pacific Avenue. Closing date for tenders, August 20th.

Toronto, Ont.
Plans have been prepared in connection with the erection of a waiting room and public library accommodation at Sunnyside Bridge. Tenders will be called for if the Property Committee approve the plans. Commissioner of Works, R. C. Harris, City Hall.

Victoria, B.C.
The matter of constructing a public abattoir, at a cost of $20,000, is under consideration by the City Council. Clerk, W. J. Dowler; Engineer, C. H. Rust.

Walkerville, Ont.
Tenders are open and will be received by the Secretary of the Dominion Government Department of Public Works, R. C. Desrochers, Ottawa, until 4 p.m. August 26th, for Post Office and Customs fittings. Plans and specifications are with C. A. Williamson, Clerk of Works, Walkerville; Thomas A. Hastings, Postal Station "F," Toronto, and the Department, Ottawa. Specification and form of tender are only to be obtained at the office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

CONTRACTS AWARDED.

Barrie, Ont.
Excavating is being proceeded with in connection with the proposed public library, to be built at a cost of $15,000. Architects, Chapman and McGiffin, 95 King Street E., Toronto. General contractor, Ball Planing Mill Company, 74 Bayfield Street; masons, Goodson and Burridge; carpenters, general contractors. Town Clerk, A. W. Smith.

Bothwell, Ont.
The general contract for the erection of the town hall has been let to Colin Reid and Brothers, Bothwell. Approximate cost, $8,500.

Cardston, Alta.
Work is to start at once on the erection of a school, at a cost of $46,250. The general contractor is H. A. Christensen, Cardston. Chairman of School Board, M. A. Coombs; secretary, J. Emer Harris. Architects are Pope and Burton, Salt Lake City. Building will consist of twelve rooms, brick and tile construction, the work to be completed by May 1st, 1916.

Cobalt, Ont.
Alterations are being made to the Public School. Chairman of School Board, W. E. T. Barton; Secretary, Alex. Hope. Architects, Angus & Angus, North Bay, Ont.; general contractor, Tully Barton.

Fort William, Ont.
The foundations are in of the Hospital Elevator under construction by the architect and general contractor, S. J. Mcqueen, 23 Murray Block, for the owners, Western Terminal Elevator, West Fort William. The specification provides for a capacity of 70,000 bushels, size 42 x 14, and of reinforced concrete construction. All work is being done under the supervision of the general contractor.

Middlechurch, Man.
Work has been started on the erection of the Old Folks Home, at an estimated cost of $11,000. General contractor, S. Brynjolfsson and Company, 506 Builders Exchange, Winnipeg. Architects, James Chisholm and Son, 807 Great West Permanent Building. Building is to be of frame and brick construction. Steel-work is being carried out by the Vulcan Iron Works, Limited, Port Douglas, Winnipeg. Other separate contracts have not yet been let.

St. John, N.B.
Work has been started on the repairs to be made to St. Stephen Church at a cost of $3,500. General contractor, E. S. Hennigar, 26 Orange Street; Pastor, Rev. Gordon Dickie.

Winnipeg, Man.
The walls are going up of the church on River Street, under construction by general contractors, Fort Garry Construction Company, Ross and Arlington, for the owners, First Church of Christ (Scientist). Architects, Gordon and Over, 47 Canada Life Building. Subcontracts have been let as follows:—masonry, carpentry and interior fittings, general contractor; steel, Vulcan Iron Works, Limited, Port Douglas, Winnipeg; roofing and plastering, not let; painting, Taylor Painting and Decorating Company, Garry Street; heating and plumbing, Beairsto Plumbing Company, Limited, 286 Fort Street; electric fittings, Levvy Electrical Company, Limited, 493 Portage Avenue.

Business Buildings and Industrial Plants

Amherstburg, Ont.
The erection of a cold storage plant, at an estimated cost of $10,000, is contemplated by the Falls Barron Company, Amherstburg. Architect has not yet been appointed.

Calgary, Alta.
The construction of ten new elevators for the Western Canada Flour Mills Company will start soon.

Collingwood, Ont.
A by-law to loan The Bryan Manufacturing Company, Minnesota Street, $20,000 to rebuild planing mills recently destroyed by fire, was defeated.

Esquimalt, B.C.
Tenders are to be called soon by the Imperial Oil Company, Limited (Manager, A. M. Abbey), for the erection of an Oil Refinery, etc., at a cost of $175,000. The construction is to consist of a two-storey warehouse, 100 x 80, concrete basement, structural steel covered with galvanized iron; wharf 200 ft. long

with 50 ft. T in deep water; boiler house 25 x 50, brick and steel construction, office 15 x 30, brick construction, stable and sheds, elevator. The Company will do tank erecting.

Galt, Ont.
Plans have been prepared in connection with the proposed alterations and additions to the factory of the Galt Machine Screw Company, Front Street. The site has been purchased and an early start is expected. Secretary-Treasurer for the company, C. K. Janzen.

Goderich, Ont.
Work is to start at once on the erection of a shell factory here for the Doty Engine Company, Limited, Brock Street. Machinery is to be purchased at once.

Hamilton, Ont.
The erection of a one-storey garage is contemplated by Willoughby Ellis, 76 Myrtle Avenue, at an estimated cost of $4,000.

London, Ont.
Additions to their factory on York Street, are contemplated by Beatty Brothers, Limited, at an estimated cost of $3,000.

The Victor Amusement Company, per G. Holding, care Street Car Company, Dundas Street, contemplate the erection of a dance hall, to cost $3,500, size, 125 ft. x 60 ft. The company expect to start work about September 15th.

Montreal, Que.
Plans are in progress in connection with the alterations to the factory of C. H. Johnson and Sons, Limited, 8 Dagenais Street, at an estimated cost of $3,000. Designer and general contractor, A. F. Byers and Company, 340 University Street.

Mount Forest, Ont.
Work has been started on the rebuilding of the store and express office owned by Mrs. Luxton, and recently destroyed by fire. Day-labor is being employed; estimated cost, $3,000.

New Westminster, B.C.
The erection of a new business block on Columbia and McNeedy Streets, at an estimated cost of $6,000, is contemplated by James Cumming, the building to be two storeys high.

Quebec, Que.
Plans are in progress for the erection of a pool room for the Quebec Olympia Company, 229 St. John Street (president, J. H. Paquet, 286 Grande Allee). Architects, Tanguay and Lebon, 20 D'Aiguillon Street. The building is to be four storeys high, 30 x 100, concrete foundation and brick construction. Estimated cost $15,000.

St. John, N.B.
The remodelling of La Provincial Bank building is under contemplation. Manager of the bank, Dufferin Harper, Germain Street. The building would be of 1 storey, 25 x 100, and would approximatelycost $12,000.

Work, by day-labor, has been started on the remodelling of a warehouse on Church and Germain Streets, for Mark Fisher and Son, Montreal, (local manager, H. H. Harvey, 93 Germain St.)

Plans are in progress for the remodelling of the store on Charlotte Street, owned by the Puddington Estate (lawyer, H. F. Puddington, Market Square). There will be a new front and fixtures installed, and the premises will be turned into a book store, at an estimated cost of $3,500.

Toronto, Ont.
Excavation is being proceeded with in connection with the erection of two stores and apartments at 1259 St. Clair Avenue, W., to cost $4,000. Owner and general contractor, M. Helfand, 1378 St. Clair Avenue W. The owner has purchased brick. Buildings will consist of two storeys, brick construction.

Vancouver, B.C.
Plans are being prepared for the erection of a factory here. The owners, W. H. Malkin Company, Limited, 57 Water Street, intend to install and purchase machinery for the manufacture of food products.

Welland, Ont.
The erection of a zinc reduction plant is contemplated by the Weedon Mining Company, Weedon Station, Que. The company have acquired a large industrial plant here and expect to be in operation by November 1st.

Zurich, Ont.
Excavating is going on for the erection of a farm building, at an estimated cost of $3,000, by Blackwell Brothers, Parr Lane, Zurich. The owners are taking charge of the general contract, the building to be of concrete and stone foundation, and frame construction.

CONTRACTS AWARDED.

London, Ont.
The walls have been started of the four stores under construction, at a cost of $10,000, by P. B. Fetterly and M. Aylesworth, Huron and Erie Streets. The architect is W. G. Murray, Dominion Savings Building. Sub-contracts have been let as follows:—masonry, John Moran, 437 Maitland Street; plastering, John Fenn, William Street.

In connection with the additions to be made at a cost of $3,000 to the factory of Beatty Brothers, Limited, York St., the brick work contract has been awarded to Evans Brothers, 905 Queen's Ave. The owners will do therest of the work.

Montreal, Que.
The following contracts have been let in connection with the factory being built on Davidson Street for B. J. Coghlin and Company, Limited, 2025 Ontario Street E.:— Masonry and brick, Gray and Wighton, 244 Pine Avenue; carpentry, D. M. Long, 204 William Street; steel, Structural Steel Company, Limited, 10 Cathcart Street; roofing, George W. Reed and Company, 37 St. Antoine Street; painting, W. E. Potter and Company, 46 Benoit Street; heating and plumbing, John A. Gordon, 301 St. Antoine St.; glazing, Henry Walker, 577 Chambord Street; metal sash, Stinson-Reeb Builders Supply Company, Read Building.

Ottawa, Ont.
The walls of the three-storey laundry under construction on Argyle Avenue are now up. The laundry is owned by the Ottawa Sanitary Laundry Company, 174 Carling Avenue, president, M. M. Pyke. General contractor, T. C. James, 140 Flora Street; architect, Richards and Abra, Booth Building. Painting, W. G. Adamson, 126 Sparks Street.

Sherbrooke, Que.
The contract for additions to the Market Building, at a cost of $7,400, has been awarded by the City Council (Clerk, E. C. Gatien) to Loomis, Dakins, Limited, St. Gabriel Street. Engineer, Thomas Tremblay.

St. John, N.B.
The general contract, in connection with the erection of a business building, has been let by the owner, James Kennedy Estate (George Kennedy), care of Vassie and Company, 20 King Street, to Stanley Williams, Prince William Street. Electric fittings are being carried out by Frank Jones, Prince William Street. Architect, F. Neil Brodie, 42 Princess Street.

Winnipeg, Man.
The contract, in connection with the alterations and additions to the Criterion Hotel, owned by John Wilkes, has been granted to the Standard Construction Company, 1004 Union Trust Building. The general contractor is also doin tghe masonry, carpentry, roofing and plastering. Steel work is being carried out by the Manitoba Bridge and Iron Works, Logan Avenue, West Winnipeg. Architect, H. W. Green, 303 McGreevy Block.

Residences

Amherstburg, Ont.
The remodelling of his residence, at a cost of $3,500, is contemplated by the owner and architect, William Hackett, care Hackett Dredging Company. The residence will be veneered with white brick and extensive colonial verandahs built.

Colchester South, Ont.
Albert Mulder, Colchester South, Harrow, Ont., will erect a new residence to replace the one destroyed by fire. Material to be purchased.

Halifax, N.S.
The foundations are in for flats to be erected by James Hilis, of Hillis & Sons, Limited, at a cost of $8,000. The architect is W. J. Busch. The Hillis firm are doing the work with their own staff.

Kingston, Ont.
The erection of two residences, at a cost of $4,000, is contemplated by William Snowden, 203½ Alfred Street. Owner will do general contracting, buildings to be of brick construction.

Montreal, Que.
Work has been started on the erection of three flats on Fourth Avenue, Rosemount Ward, by Henry Dubarras, 274 Fourth Avenue. Estimated cost, $3,500.

Plans are being prepared for three flats on Harvard Street estimated to cost $9,000. The buildings are to be three storeys high, concrete foundation, felt and gravel roofing, with hot water heating. The owners and general contractors are A. F. Byers & Company.

The foundation work has been finished for six flats on Verville Street. The owner and general contractor is John Pratt, Park Avenue.

The two residences which are being

erected by Anglins, Limited, on Marlowe Street at a cost of $10,000 have reached the roofing stage.

Ottawa, Ont.
The owners and general contractors, Charles Holbrook & Son, are buying electric fixtures and interior fittings for their apartment house on Elgin Street, which has been erected at a cost of $20,000.

Quebec, Que.
A residence estimated to cost $5,000 is to be erected on Marie de L'Incarnation Street by Wilfrid Leagre. The building will be three storeys high, of brick construction, and will be built by day labor.

Excavating is under way on a store and residence on First Avenue for A. A. Body, Ste. Famille Street. The building will be of frame and brick construction, and will cost $3,000.

Tara, Ont.
The erection of a residence on Yonge Street at a cost of $3,000 is contemplated by the owner and architect, William Munson.

Toronto, Ont.
The foundations are in of a pair of residences on Bingham Avenue, to cost $5,000. The owner is H. T. Dixon, 106 Scarboro Road, who will buy material and sublet labor. The buildings are to be two and a half storeys, brick construction, electric lighting, hardwood floors, lime and sand plastering.

Excavating is being proceeded with on a stone and residence being erected at 1182 St. Clair Avenue at a cost of $3,000. The owner is R. H. Penprays, 94 Geary Avenue, who lets all contracts. The building is to be three storeys, of brick construction.

The foundations are in of a pair of residences being built at 3491 Appleton Avenue at a cost of $6,000. The owner is W. J. Rogers, 42 Appleton Avenue, who buys materials and superintends constructions. The buildings are to be two and a half storeys, of brick construction.

The foundations are in of a $2,000 detached residence at 86 Mulock Avenue. The owner and general contractor is C. Wagner, 88 Mulock Avenue, who will superintend all work. To be of two 9storeys, brick construction, gas lighting, hot air heating, shingle roofing, birch and spruce floors, lime andsand plastering.

Work is to start shortly on a pair of residences at 30-32 Palmerston Square, costing $3,000.9 The owners and general contractors are Venn & Evans, 776 Crawford Street; they will let smaller trades. Two storeys, brick construction, hot air heating, electric lighting, lime and sand plastering, mantels.

The foundations are in of a pair of residences being erected at 235 Melita Avenue at a cost of $6,000. Owner and general contractor, J. H. Larkin, 6 Ravensden Avenue. Owner buys material and superintends construction. Two and a half storeys, brick construction, stone foundation, hot air or combination heating, hardwood floors.

Work has started on the erection of four pairs of residences on Wolverleigh Boulevard estimated to cost $16,000. The owners and general contractors are Orford & Hill, who will purchase all material. At present contracts have been let for masonry and carpentry work only. Of brick construction, electric lighting, hot air heating.

The walls have been started of a pair of residences on Atlas Avenue, to cost $6,000. Owner and general contractor, in trust, H. Lefneski, 423 Roxton Road. Owner will supervise construction. Two and a half storeps, brick construction, gas and electric lighting, hardwood floors.

Work is in progress on two two-storey brick residences on Central St. estimated to cost $4,400. The owner and general contractor is J. W. Butchart, who is buying material and superintending construction.

Westmount, Que.
The foundation work has been completed for two two-storey brick residences on Willow Avenue to cost $15,000. General contractors, Anglins, Limited.

CONTRACTS AWARDED.

Glen Falls, N.B.
Work is to start at once on the remodelling of the Manor House building, at an estimated cost of $4,000. The general contractor is James F. McDonald, 226 Duke Street, St. John, N.B. Owner, William Pugsley, Pugsley Building, St. John, N.B.

Hamilton, Ont.
The walls are up one storey of the $8,000 residence being built for William Laking on Emerald Street South. The building is to be two storeys, of brick construction. Architects, McPhie, Kelly & Darling; general contractor, masonry, carpentry and roofing, A. W. Woodhall, King Street East; plastering, J. Clapman, 349 Jackson Street West; painting, Goodale & Laidlaw, 20 Hunter St. East; heating and plumbing, Geo. Stevenson, Walnut Street; electric fittings, not let.

Niagara Falls, Ont.
Contracts for heating, plumbing and electric lighting are about to be let on the $3,500 residence which is being erected by John Dawson according to plans prepared by Architect J. U. Collins.
Business Buildings........

Sub-contracts are being awarded on the $11,000 residence on Gilmour Street which is being erected for T. D. McFarlane by Taylor & Lackey according to plans by W. E. Noffke.

North Sydney, N.S.
Work has been started on the erection of a residence by L. B. Wilson, care Cable Office, who has awarded the general contract to Mr. McMilan.

Ottawa, Ont.
Excavating is in progress on the $5,000 apartments on Creighton Street which are being erected by August Boehmer for W. S. Sherwood. The construction will be brick veneer, with concrete foundation, felt and gravel roofing, electric lighting, and hot air heating.

Peterboro, Ont.
In connection with the construction of his residence at a cost of $12,000, A. W. Cressman, 212 Brock Street, has awarded the masonry contract to F. and A. E. Ham, 83 Salem Avenue, Toronto. Other contracts have not yet been closed. The building is to be of stone and brick construction, hot water heating. Architects, S. B. Coon and Son, Ryrie Building, Toronto.

Quebec, Que.
The general contract for repairs to residences on Victoria Street has been let by Dion and Freres, 84-6 Victoria Street, to A. Deslauriers, 400 St. Francois Street. Approximate cost, $3,000.

In connection with the residence being built on Third Avenue by G. J. Belanger, 1 Second Street, Limoilou, the contract for roofing has been let to A. D. Breton, 235 Kironac Street. Painting, plumbing and electrical work not yet awarded.

Seaforth, Ont.
Work is to start at once on the erection of a residence on John Street at a cost of $3,000. The general contract has been awarded by Thos. Elder to William Bristow. The building is to be of frame and white brick construction, concrete and stone foundation.

Westboro, Ont.
The walls are going up of a $3,500 residence on John Street. Owner, architect and general contractor, W. Fields. Electric fittings, J. E. Lewis; brick veneer construction, concrete foundation, shingle roofing, birch floors.

Power Plants, Electricity and Telephones

Chesley, Ont.
The Chesley Chair Company, Limited, are in the market for one direct current dynamo, with a capacity of about 100 lights.

Durham, Ont.
At a public meeting recently held, a resolution was carried to advise the village council to erect a new Hydro-electric sub-station on the site of the old market building. Village, Clerk, William B. Vollet.

Liverpool, N.S.
A By-law has been carried to make an expenditure of $10,000 on repairs to the electric plant. Town Clerk, T. R. Bartling.

London, Ont.
A proposition is up for consideration for an addition to the lighting system, to cost $10,000. The Public Utilities Commission and Board of Control now have the project in hand. City Clerk, S. Baker.

CONTRACTS AWARDED.

Oakbridges, Ont.
The foundations of the power house, under construction for Christian Bros., Duke Street, Toronto, by the general contractors, Thomson Brothers, 151 Rusholme Road, Toronto, are now in. Other contracts have been let as follows:—Heating, Canadian General Fire Extinguisher Company, Limited, 1200 Dundas Street; mechanical equipment, International Engineering Works, Limited, Traders Bank Building, Toronto.

Wawota, Sask.
Work is in progress on the installing of a telephone system by the Wawota Rural Telephone Company, at a cost of $7,300. The general contractor is W. E. Bobier, Moosomin, Sask., who will purchase all material. About 130 miles of wire and 60 pole miles will be required.

(Continued on page 51)

Tenders and For Sale Department

Tenders Wanted

Sealed tenders, marked "Tenders for Overhead Travelling Crane," addressed to the Chairman of the Toronto Electric Commissioners, will be received until noon, **Thursday, August 26th.** Specification and form of tender can be obtained at the office of the Purchasing Agent, 15 Wilton Avenue. The lowest or any tender not necessarily accepted. 33

JUDICIAL SALE OF ASSETS
of the
Bowmanville Gravel Company, Limited

Tenders will be received addressed to J. A. C. Cameron, Esq., Official Referee, Osgoode Hall, Toronto, and marked "Tender re Bowmanville Gravel Company, Limited," up to 12 o'clock noon of the **30th day of August next,** for the purchase of the assets of the above named Company. Such tenders shall be for either or both of the following separate parcels,—

(1) A certain valuable concession for the removal of sand and gravel from lots twelve and thirteen in the Broken Front Concession of the Township of Darlington in the County of Durham. These lots adjoin a creek or river running into Lake Ontario near the Town of Bowmanville, and on them there is a very large and valuable deposit of gravel to which a channel has been dredged out so as to permit of easy access for scows and other machinery necessary for removal of said gravel. This deposit of gravel is within easy reach by water transportation of the Toronto Harbor, where enormous works are contemplated by the Toronto Harbor Commission, and is also within easy reach by water transportation of the Welland Canal, where the operations now being carried on also require large quantities of gravel. The material on this concession is said to be well graded and is within a naturally protected harbor. On the site are large offices and a camp for boarding men, with equipment.

(2) A light steam tug or launch 40 ft. x 7 ft. 6 in., having 25 H. P. Engine, High and Low Pressure.

The agreement relating to the concession can be examined and further information regarding the assets of the Company can be obtained at the office of L. Waldeck Archer, the liquidator, 18 King Street West, Toronto, and the property covered by the concession and the tug or launch may be inspected upon application to him.

Terms of Sale

Twenty-five per cent. in cash and the balance at one and two months, secured to the satisfaction of the liquidator. A marked cheque payable to the liquidator of five per cent. of the amount of tender must accompany each tender, which cheque will be returned if the tender is not accepted.

The tenders will be opened by J. A. C. Cameron, Esq., at his Chambers, Osgoode Hall, Toronto, on the 31st day of August next at the hour of 11 o'clock a.m. and all who tender are then requested to be present.

The highest or any tender not necessarily accepted.

Parcel number two sold subject to a reserved bid. The other conditions of sale are the standing conditions of the Court so far as is applicable.

Dated at Toronto this 9th day of August, A. D. 1915.

J. A. C. CAMERON,
Official Referee.

This notice is published by A. Cameron Macnaughton, 18 King Street West, Toronto, Solicitor for liquidator. 33

Tenders for Street Paving

Sealed tenders, addressed to the undersigned, will be received up to 6 o'clock p.m., **Thursday, August 26th, 1915,** for the Excavation, Concrete Base, Binder, Wearing Surface, and Curb and Gutter, of a Trinidad Lake Asphalt Pavement, on a portion of Pinnacle Street, in the City of Belleville.

Plans and specifications, and all other information obtained at the office of the Engineer, City Hall.

Approximate amount of pavement 5,104 square yards. The lowest or any tender not necessarily accepted.

A. C. McFEE,
Chairman of Public Works,
33 Belleville, Ont.

Department of Railways and Canals, Canada.

TRENT CANAL

Notice to Contractors

Sluice Pipes, Valves, Etc.

Sealed tenders, addressed to the undersigned and endorsed "Tender for Sluice Pipes, Valves, operating machinery, etc., Trent Canal," will be received at this office until 12 o'clock noon on **Wednesday, September 1st, 1915,** for the manufacture, delivery of, construction and erection complete of sluice pipes, valves, operating machinery and electrical equipment for the Swift Rapids Dam, Trent Canal.

Plans, specifications and forms of tender can be obtained by application to the Chief Engineer, Department of Railways and Canals, Ottawa, or to Superintending Engineer of the Trent Canal, Peterboro, Ont.

An accepted bank cheque on a chartered bank of Canada, equal to 10 per cent. of tender, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contracts for the work at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

J. W. PUGSLEY,
Secretary.

Department of Railways and Canals,
Ottawa, 12th August, 1915.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—84240. 33

To Contractors

Separate sealed tenders accompanied by a marked cheque for 5 per cent. of the amount will be considered at the Township Hall at 4 o'clock p.m., **August 30th,** for the following work in the Township of Logan:—

1. The repairing of the N. W. drain from concession 13 to near the junction of the Grey branch.
2. From concession 10 to the outlet.
3. The repairing of the McNaught drain.

Specifications may be seen at the Clerk's office, lot 16, concession 6. The lowest or any tender not necessarily accepted.

MARVIN LEAKE, Clerk,
R. R. 5, Mitchell, Ont.
August 13, 1915. 33-34

Tenders Wanted

Tenders will be received by the undersigned, Township Clerk, up to 2 o'clock p.m. on **Saturday, the 21st day of August, 1915,** for the construction of Municipal Drain No. 3 in the Township of Maryborough, containing about 25,332.0 cubic yards of excavation.

Plans, profiles and specifications of this drain may be seen at the drug store in the village of Moorefield or at the engineer's office at West Montrose.

The lowest or any tender not necessarily accepted. Satisfactory bondsmen or a marked cheque for 5 per cent. of tender will be required.

W. W. SCOTT,
Clerk of the Twp. of Maryborough,
Moorefield P. O.

C. D. BOWMAN,, O. L. S.,
Engineer-in-charge,
32-33 West Montrose, Ont.

TENDERS
Electric Crane, Hoist, Etc.

Tenders will be received through registered post only, up to noon on **Tuesday, August 31st, 1915,** for the supply and erection of an Electric Crane, Hoist and Single Line Clam Shell Bucket at the Main Sewage Disposal Works, Toronto.

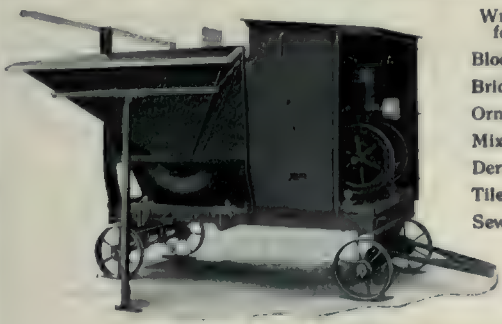
Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of envelope as to contents.

Specifications and forms of tender may be obtained at the Works Department, City Hall.

Tenderers must comply strictly with conditions of City By-laws as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
Toronto, August 11th, 1915. 33

For Additional Tenders See Page 52



Write us for information on:
Block Machinery,
Brick Machinery,
Ornamental Molds,
Mixers, Tampers,
Derricks, Screens,
Tile Machinery,
Sewer Pipe Molds,
Fence Post Molds,
Waterproofing, etc.

"Windsor Ideal" Batch Mixer

Ideal Concrete Machinery Co., Ltd.
WINDSOR, ONTARIO

To Contractors, Railroads, Mines, etc., Using

Carbic Flare Lights

Notice.

All orders for CARBIC CAKES, for use in CARBIC FLARE LIGHTS will receive prompt attention if forwarded direct to this office.

Wire or Write **Immediate Shipment**

CONTRACTORS

Are you using a CARBIC LIGHT on that RUSH JOB? If you are not you are losing TIME and MONEY, and it will pay you to sit down and figure it out.

Good Light is most essential in order to make a good job, and good jobs add to your reputation as a Contractor.

On your reputation depends your future.

Use a CARBIC LIGHT on the job, and insure yourself against faulty construction, which in time will ruin your reputation as a Contractor.

Full particulars on Application

W. L. FOSTER
8 Lombard Street - Toronto, Can.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Osgood

"18" 3/4-yd. Traction Revolving Shovel, with horizontal type hoisting engines. Independent steam steering engine operated from either side of shovel; also hand steering device.

Full submerged tube type boiler built to pass inspection in all Canadian Provinces.

Shovels in stock for immediate shipment.

The Marion Osgood Company
P. O. Box 515 MARION, OHIO
Canadian Agents:—Kelly Powell, Limited—Head Office 602 McArthur Building, WINNIPEG. Branch—MONTREAL

INGERSOLL, ONTARIO

Tenders for Pavement

Sealed tenders, addressed to W. R. Smith, Town Clerk, will be received up to noon, **September 2, 1915**, for the construction of approximately 1,800 square yards of concrete pavement and 1,200 lineal feet of concrete curb.

Plans and specifications may be seen at the office of the Town Clerk, and at the office of the Contract Record, 347 Adelaide Street West, Toronto.

The lowest or any tender not necessarily accepted.

ERNEST J. HOLLAND,
Town Engineer.

33

TOWN OF THOROLD

PROVINCE OF ONTARIO

Sewerage System

Sealed tenders will be received by the Town Clerk until 8 p.m. **Wednesday, August 25th, 1915**, for the construction of a system of sanitary sewers in St. Andrews Ward, comprising about 14,225 lineal feet of pipe laying; also for the construction of sewage pumping station.

Sewer pipes are to be furnished by contractor.

Machinery to be furnished and installed by corporation.

Plans and specifications may be seen at the resident engineer's office, Thorold, or at the office of the chief engineers, Mail Building, Toronto, on and after August 13th, 1915.

The lowest or any tender not necessarily accepted.

JOSEPH BATTLE, Esq., Mayor.
D. J. C. Munro, Esq., Town Clerk.
CHIPMAN & POWER, Engineers.

32

FOR QUICK SALE
A One-Ton Motor Truck
In Excellent Condition
Will Sell Cheap for Cash
Apply J. LANG,
40 West Richmond Street, Toronto

Fires

Cache Bay, Ont.
The sawmill of Geo. Gordon & Company, Limited, has been destroyed by fire. The loss is $125,000, and the insurance $83,000.

North Vancouver, B.C.
Five cottages on Fell Avenue, belonging to Capt. Chas. Cates, 163 Hastings Street West, have been destroyed by fire. The loss amounts to $5,500, partly covered by insurance.

St. Thomas, Ont.
The smoke house, sausage room, and warehouse of the St. Thomas Packing Company, Limited, Gravel Road, have been totally destroyed by fire. The loss is $15,000, which is covered by insurance.

Thorold, Ont.
M. Kennedy's store and boarding house on Front Street was totally destroyed last week.

Miscellaneous

Anique, Que.
J. A. Brillant is receiving prices, catalogues and other information on concrete mixers, library fittings, seating fixtures, shutters, woodworking machinery, Douglas fir, interior trimmings, and hotel furniture.

Orillia, Ont.
Mr. T. B. Cramp, 37 Barrie Road, W., wants prices, catalogues, etc., on the following:—Cement, fireproofing, steel, metal lath, plate glass and joist lumber.

Toronto, Ont.
The Toronto Hydro-Electric Commissioners, 226 Yonge Street, will receive tenders until August 26th for the supply of one overhead travelling crane. Specifications at office of purchasing agent, 15 Wilton Avenue.

CONTRACTS AWARDED.

Winnipeg, Man.
In connection with the tunnel between the Central Power House and the Law Courts, the Provincial Department of Public Works have let the contract for concrete work to Tremblay and Company, 81 Sterling Bank Building, at $6,356, and the contract for piping to Cotter Brothers, Fort and St. Marys Streets, at $3,970.

Late News Items

Artemesia Township, Ont.
Tenders on the construction of a reinforced concrete bridge will be received until 6 p.m., August 21st, by the Township Clerk, W. J. Bellamy, Flesherton, Ont. Plans and specifications at office of the Engineer, R. McDowall, C. E., Owen Sound, and of the Clerk.

McAuley, Man.
The School Board have let the general contract for the erection of a school to George Minkley, 19[illegible] Robinson Street, Regina, at $12,875. Fittings will be purchased by the general contractor.

Montreal, Que.
In connection with the flats being built for M. Masson, 926 St. Denis Street, the carpentry contract has been let to the general contractors, U. Pauze & Fils Company, 326 Greene Avenue, and the contract for brick and stone work to O. Archambault, 610 Parc Lafontaine.

Ontario Province
Tenders will be received until noon, September 1st, by L. W. Pugsley, Department of Railways and Canals, Ottawa, for the supply and construction of sluice pipes, valves, operating machinery and electric equipment for Swift Rapids Dam. Plans and specifications with the Superintending Engineer, Trent Canal, Peterborough, and at the Department, Ottawa.

Ottawa, Ont.
In connection with the apartments being built at Laurier and Chapel Streets by Leon Petegorsky, 87 Goulbourne Avenue, the contract for painting has been let to W. J. Carson, 293 Laurier Avenue W., and for heating to Coldrey & Chapman, 148 Rideau Street. Plastering by day labor.

The contract for heating and plumbing at the apartments in course of erection for Frank Bossie, 542 Laurier Avenue W., has been awarded to Gauthier & Company, 307 Dalhousie Street.

Owen Sound, Ont.
Work has been commenced by day labor on the erection of an addition to the tannery of the McQuay Tanning Company, Limited, 1852 Third Avenue. Approximate cost, $15,000.

Regina, Sask.
In connection with the Mail Order Building to be erected for the Robert Simpson Company, the contract for the supply of steel reinforcing bars has been awarded to the Burlington Steel Company, Limited, Hamilton, Ont.

St. John, N.B.
Progress is being made on the erection of stores for Scovil Bros., King Street, by the general contractors, B. Mooney & Sons, 112 Queen Street. The contract for galvanized iron and roofing work has been let to John E. Wilson Company, Limited, Sydney Street. Estimated cost, $60,000.

Thorold, Ont.
The work on sewerage extension in St. Andrew's Ward, for which tenders are being received, will be sub-divided into the following contracts:—(a) sewers in westerly section of the Ward; (b) sewers in easterly section of the Ward; (c) cast iron sewage force main; (d) sewage pumping station. Engineers, Chipman & Power, 204 Mail Building, Toronto.

Winnipeg, Man.
Tenders will be received until August 21st by the Chairman of the Board of Control for the supply of between 1,000 and 2,000 square yards of creosoted wood paving blocks. Specifications at office of the Engineer, W. P. Brereton, 223 James Avenue.

A writer in the American Machinist says, in laying out drawings of machinery, it often happens that the draughtsman desires to space off a part of the work into a number of small divisions, such as, for example, the threads of a screw, the teeth of a rack, or a series of equi-distant lines upon which to plot a curve. If his scale happens to be in divisions corresponding to those desired, it may be used; otherwise the method below is useful:—Take an ordinary thread gauge and draw it lightly over the point of a soft lead pencil until the teeth become slightly coated with graphite. Then press it firmly upon the drawing at the place where the divisions are desired. It will be found upon lifting the gauge that each tooth has left its imprint on the drawing. This series of little black dots may then be used as the desired spacings.

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Water Supply, Sewerage, Sewage Disposal, Civic and General Engineering, Arbitrations, Investigations, Valuations, Reports, etc.

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Patriotism in Awarding Contracts

PATRIOTISM is of various kinds, and it has been defined in a number of ways. Webster's definition is "devotion to the welfare of one's country," but a writer of lesser vocabulary, but greater perspicacity, perhaps, has defined patriotism as "the last resort of a scoundrel." There is a patriotism that consists of great words, and there is a patriotism that finds its only expression in great deeds. The former is forgotten; the latter becomes part and parcel of history.

There are certain things which are almost forgivable in times of peace, when something is needed to relieve a nation or a people from the comparative stagnation of some of the higher qualities which prolonged freedom from conflict of any kind engenders; but these things at a time when a nation or a people is struggling for its existence are unforgivable.

As a rule, business and sentiment have little in common, but this great world-war in which the Empire is engaged provides the exception, and in all decency business to-day must be clothed at least with an outer garment of patriotism. To ignore the interests of one's people at a time when one of the most vital considerations of the country is to maintain business stability is to show a lamentable lack of true patriotism. All of which is introductory to a brief comment which we desire to make upon the action of one of Toronto's leading departmental stores in awarding the contract for an eight-storey warehouse at Regina to a Chicago firm. Our attention has been called to this matter by a number of prominent contracting firms, and we do not hesitate to express our disapproval of the action of The Robert Simpson Company—the Toronto firm to which we refer above.

The experience of a prominent Winnipeg contractor as communicated to this journal is interesting. When our correspondent heard that the Simpson Company had decided to build in Regina he wrote to their head office in Toronto asking for the privilege of tendering on the work, and offering to furnish satisfactory references as to his experience on large contracts. He received a reply thanking him for his proposal, and stating that the Simpson Company's representative, who was then in the West, would call on him—which he did several weeks later. When he called on the Winnipeg contractor he informed him that tenders for the Regina building closed on the following Monday. The explanation was forthcoming that it was first the Simpson Company's intention to give the work to an eastern contractor who had done satisfactory work for them previously, but later that it had been decided to allow three Regina contractors to figure, and that these would have the preference.

Owing to the shortness of the time, and to the explanation as to the local preference, the Winnipeg man decided not to go to the trouble and expense of making up a tender.

In another instance a Winnipeg contracting firm capable of carrying out work of any size, particularly in this class of work, was not given the opportunity to figure.

The Simpson Company secured concessions from the city of Regina on the understanding that they would erect a building and establish a branch there, and the first step they take is to give preference to outsiders, who will bring in outside foremen, and spend their profits in the United States.

Now there is no reason in the world why United States contracting firms should not come into Canada and get business—if they are able to do so in fair competition; but without open competition, and such publicity being given to the work as will enable all thoroughly competent and financially able Canadian contractors to tender, to send Canadian important contracts across the border at a time when constructional enterprise in the country is at such a low ebb is little short of treason. The offence is particularly aggravated coming from a firm that has derived its profits from the departmental store business—generally from the hard-earned purchases of the man or woman in the street—the man and the woman whose interests every properly constituted business enterprise, in common with the State itself, should have at heart.

One cannot refrain from hoping that The Robert Simpson Company's latest venture in the West will be attended by scant success. Of all things that we love, it is consistency; and it is such a gross outrage upon consistency—and upon decency—for a departmental store to make its money out of the Canadian people and spend it in the United States that we cannot find it in our heart to take a charitable view of the offence. At a time when Canada and the Empire have vital need of all the internal business developed within the country—at a time when British lives are being laid down by thousands in the cause of Empire—there can be nothing urged by way of palliation.

Montreal Water-Works—The Need for an Expert Investigation

As reported in our issue of Agust 11, the Council of the Canadian Society of Civil Engineers have unanimously asked the city of Montreal to appoint an independent board of engineers to study the proposed further expenditure on the Montreal filtration plant, aqueduct, hydro-electric scheme, etc. The original plans have been gradually altered and enlarged until the scheme has taken on a different aspect; the expenditure, too, has been added to at quite an alarming rate, and the end is by no means in sight. The cost may be ten millions, or eleven, but the scheme has been built up in such a piecemeal fashion that the total expenditure is still in doubt. Owing to the method by which extensions have been made, we understand that the entire scheme has not been reported on by any engineer. There have been reports on the original plans, reports on the conduits, reports on various other sections, but a real comprehensive report on the whole undertaking, including a proposed fresh expenditure of over four millions, has yet to be made. Some of the reports in favor of the plans were almost ancient, and one of the past presidents of the Canadian Society of Civil Engineers, and whose name has been publicly used in support of the project, publicly repudiated the use of his name to support the scheme as it now stands.

Apart from the design of the retaining walls, which are to be strengthened as the result of a wall constructed for test purposes, the chief objection is to the portion of the scheme dealing with the proposed hydro-electric development to give 10,000 horse power for pumping and lighting purposes. In February, 1914, Messrs. J. A. Jamieson, R. S. Lea, and G. R. Heckle, in reporting on the water supply conduit, made a most emphatic recommendation that a board of engineers be appointed to investigate the aqueduct section, including revised estimates of the cost of construction and the quality and cost of the power developed. Nothing was done, but in place of it are recommendations to spend large sums on installing the necessary equipment for a power station. It is contended that the enormous expenditure will mean that the city will be paying interest charges alone, to say nothing of working costs, which will be many times more than the price at which electricity can be purchased in the city. This will be a heavy burden on the city, and competent engineers believe that this is unnecessary and that a considerable saving could be made.

The Canadian Society of Civil Engineers argue that the only way to get to the bottom of this matter is to have all the facts investigated by an independent board of engineers; there is at present no sign of the Board of Control acquiescing in this suggestion—Mr. Controller Cote says it is an efficient and economical scheme—but we believe that the Society will follow up their recommendation in order to bring the weight of expert and public opinion on the Board of Control. There is a want of confidence on the part of engineers as to the business methods of the city of Montreal, and the events of the last few months in relation to the giving of contracts for paving go a long way to justify their scepticism as to whether the water-works scheme is not another of the civic muddles. Any doubt as to the value of the scheme, whether from the engineering or financial standpoints, can be easily set at rest by appointing men of undoubted ability to investigate the entire project. If it be as satisfactory as the city suggest, then the public will be satisfied that they are spending money on a reasonable proposition, but if the scheme be found impracticable except at an excessive cost, the few thousand dollars spent on the inquiry will be money well laid out, for it will prevent the expenditure of many hundreds of thousands on a plan which is unsound.

A Dangerous Precedent

A clerical error in a bid submitted is a frequent cause for controversy between the contractor and the owner. In some cases the error may be so large that a forfeiture of the bidding deposit is the cheapest way a company can get out of the situation, if the owner is willing to permit this expedient without suit for added cost of construction. In other cases, the error is small enough so that the company can afford to go through with the contract and accept the reduced profits. In a few instances, the owners will allow the contractor to correct his clerical errors and submit a revised bid. .

A case of this kind has recently arisen in an eastern city where a contracting firm recently submitted the lowest bid on a sewer contract, a bid nearly $17,000 lower than any of its competitors on a $58,000 contract. The contract had been awarded to this company, when it was discovered that clerical errors in figuring manholes, walks and other accessories, had made their bid $1,240 too low.

The president of the contracting firm then called the attention of the city authorities to the error and asked leave to correct it. The great difference in the bids of this company and the next lowest bidder, as compared with the amount of the error, caused the city authorities to allow the correction of the bid and, instead of $56,886, as originally submitted, the contract was made out and signed with the amount set at $58,126.

We do not believe that this is a good policy for a municipality to follow. It establishes a precedent in matters of this sort which may prove decidedly dangerous. A contractor might conceivably submit a bid with known "clerical errors." If the bid were low enough to secure the award with these "clerical errors" corrected, the contractor could call them to the attention of the city and have his bid raised. If the bid barely won out over a competitor, nothing would have to be said about the errors, but the bid as submitted could be allowed to stand.

Such a possibility would give an unscrupulous contractor a chance to impose on the municipality and would be decidedly unfair to other bidders. It should be a firmly established rule that a bid submitted cannot be altered in any way whatsoever. A contractor should prepare and check his bid so carefully that there is no possibility of a clerical error and should then be compelled to stand by the bid submitted or else forfeit his certified check and accept whatever other legal action is taken. So far as we know, the action taken in the individual case cited was fair enough, but as a precedent established it must be severely condemned.

Can "Good Times" in America Come from the War in Europe?

The U S. Viewpoint as expressed by Engineering & Contracting, Chicago

MANY political economists have answered this question in the negative. They are of the school that reasons that any large "destruction of wealth" in any part of the world inevitably reacts unfavourably upon wealth production in other parts of the world. But it is noteworthy that they rarely define "destruction of wealth." The fact is that nearly all wealth is "destroyed" almost as soon as it is created, if by "destruction" is meant consumption. Hence an explosion of ammunition is a "destruction of wealth" that does not differ essentially from the wearing out of a silk dress or the drinking of a cocktail.

A very small percentage of the wealth produced annually is added to the world's stock of wealth. This stock is capital, and is largely used as an instrument for producing more wealth. To destroy capital in large quantities may very well lead to the impoverishment of its owners, but to destroy wealth not used as capital is quite another matter.

A comparatively slight amount of the world's capital has thus far been destroyed by the great war, and there is no likelihood that any considerable percentage will be destroyed. It is important to bear this in mind when discussing the probable effect of the war upon America.

Any great sudden change in the productive energies of a nation must inevitably absorb other nations temporarily. It is not "destruction of wealth" that causes such disturbance, however. The real trouble arises from the hesitancy of business men to change their lines of output, or to continue their normal output in the face of uncertainties as to markets. But as time passes, business leaders begin to modify their action to suit the conditions, and "times revive." This revival has been happening in America at a very rapid rate during the past six months.

The textile trades, the metal industries, grain farming, and many other industries have shown marked growth. Consideration makes it apparent that the revival will continue and will spread to other industries.

The war has diverted the energies of millions of men from the production of utilities that were formerly exported to us. America must, perforce, either go without those utilities or proceed to produce them herself. She has done both. There has been some economizing and there has been some enlargement of home production.

Our exports have necessarily changed considerably in character, but they have grown to such proportion that the ensuing twelve months seem likely to yield a balance of trade amounting to $2,000,000,000 in our favor. The effect of this will be to cause a flow of gold to America, slow at first but greater when the war ends. This will cause a rise of prices in America. It will also result in our purchase of American securities now held by Europeans. Neither of these occurrences spells financial depression. So long as prices are rising it is wise to invest in plants capable of producing income, and it is relatively unwise to invest in bonds. Hence in times of rising prices men expand their investments in plant, supplies and goods.

The transfer of American securities from Europe to America will itself result in increasing the permanent supply of cash capital, for interest and dividend payments will flow in diministed stream abroad. Our exchange of products for these securities will therefore tend to increase prices here by decreasing the annual flow of gold to Europe. And, as just stated, an era of rising prices is an era of "good times," for it leads to aggressive action by investors and business men.

The close of the war will cause another readjustment, but this time not in an atmosphere of gloom. On the contrary, the spirits of all Europe will rise. Optimism will give impetus to every trade. "But," argues the school economist, "how can there be revival where debts bow men's backs to the dust?" Debts to whom? Mostly those of the government to its own people, and this means the debts of citizen A to his neighbor B, and of B to A. The rich and well-to-do may suffer most as a result of war taxes, but this is by no means certain, for it is they who hold most of the bonds issued by the government. They will have economized during the war sufficiently to have paid a large part of the cost of the war. The instruments of production will have remained uninjured, for the most part. Men will man them, and history will repeat itself in showing "an amazing industrial recovery"—amazing chiefly because we are so accustomed to regard war as a great destroyer of capital, which ordinarily it is not.

Men by the millions will have died. Will this cripple European industry? Not for long. This war, nearly all thinkers agree, is really a struggle for industrial supremacy. If so, it means but one thing—an overcrowding of Europe with workers whose wares do not find ready markets. Already reports are reaching us that English workmen are enjoying prosperity such as few of them have ever tasted. Cruel as the process of extermination of men is, the men that are left are apt to be better off than if no extermination had taken place. This heartless condition is not the ideal toward which the world moves, but is none the less a present fact that we cannot ignore.

A great war is a great stimulus to actions of many sorts other than military as well as military. It shakes even the somnolent type of mind into wakefulness. Many it kills but many more it cures. Our civil war served to develop thousands of young men into self-reliant and ambitious leaders who afterward made their marks in the halls of industry. This is seemingly one of nature's compensations for tre sacrifices of battle.

While we do not indorse war as a thing to be desired, as some have claimed it is, we may well take comfort in the compensations that it brings—and they are by no means negligible. To America the gains are, by all odds, greatest. This is bearing home upon our attention already. We shall see still greater commercial benefits with the passage of every month, and they will not cease when the war ends.

"Inaccuracies" of the Press

IN the smaller cities—and, for that matter, in the larger ones also—there is lamentable carelessness in the recording of engineering details. At best, the handling of technical data and figures by men of no special training can be only a makeshift. So that when there is a strong suspicion of misrepresentation into the bargain the situation becomes intolerable.

An instance of this has just occurred at Berlin, Ont., where a section of the local press has been endeavoring to place upon the City Engineer the blame for certain defects in the sewerage system. In support of its arguments it was reported in a leading editorial that the estimated cost of repairs found necessary by the consulting engineer, Mr. Willis Chipman, was $6,500, whereas the actual amount was $65.

It is strange that a typographical error of such an extraordinary character should occur in the editorial column of a paper which throughout had been putting the local engineer in the worst possible light. At best it is a wretched coincidence; at worst it is suggestive of the kind of malevolence which would be deserving only of contempt were it not for its misleading effect upon the public and its injustice to the engineering profession.

Are Architectural Competitions a Mistake?

THERE seems to be a growing feeling among architects, that competitions are a mistake; and the architectural profession may certainly take it that members of professions outside their own think so too, for it is hard to understand why this profession should, to the extent it is, be subjected to the hardships inseparable from a competition. That there are hardships scarcely needs pointing out. In the first place, the chances are greatly in favour of the man in large practice, because he either maintains a large staff or can afford to engage a special staff for a competition; he can use the combined skill of all this staff, merely supplementing it with his own, to turn out his design, while a man less favorably placed has to do practically the whole work, mental and mechanical, unaided. In such circumstances the balance of advantage clearly lies with the first, just as it would in a race where a machine of small horse power is in competition with one of much greater capacity. The unfairness of it between man and man is thus inherent in every competition. Then as to the effect on the work produced there is this to consider. Conditions have to be laid down more or less rigidly which all competitors must observe. The designer may see a way of ignoring some of these and by so doing vastly improving his design, but he dare not, nor dare his client, if consulted, agree to his doing so, because if he did he would be unfair to the other competitors. It will happen sometimes, however, that a bold step is taken, a condition, or two, is evaded, and a design is produced that by its intrinsic merits captures the client or assessors. They would probably refuse to sanction the change, if asked beforehand; but if it is made without their being asked and is perceived at the same time as the improvement effected comes before them, they are disarmed and are apt to condone it. But a step of this kind can be taken only by the experienced competitor. He has learned how much rope the average assessor may be expected to allow and boldly goes the full length of it, while the less experienced man is too timid to take an inch of it. And here again the latter suffers from a certain degree of unfairness. It is usually said that a competition calls out a man's best efforts; but we think for more than one reason that this is a doubtful assumption. When a man is taken from work on which his daily bread depends to embark on what to him is a mere speculation in which his chances of success are in most cases remote, is he likely to put his best into the speculative work? One with the spirit of the gambler might, but the man of sober and earnest mind is more likely to feel towards his competition work as one feels towards the lighter occupations of life, something to be taken up lightly when the real day's work is over, something in which no high hopes are centred and therefore for which his highest efforts are not reserved. This, we take it, is the spirit in which competitions are entered upon by all except the sanguine few who have been endowed by nature with energies sufficient to be devoted equally to the shadow and to the substance. When, again, a man is engaged upon a competition he is, humanly speaking, bound to consider the idiosyncrasies of the assessor, or the principal one of the assessors when there are more than one. Assessors are men naturally well known in the architectural world; from their own works their tendencies can be judged, so the discerning competitor is extremely likely to put on one side some of his own originality if he can produce in its place work that is likely to please the individual by whom his work is to be judged; and so his work is not as free as it otherwise might have been. In a system under which a client comes to an architect, tells him in a general way what he requires, definitely makes over the work to him, and is accessible for consultation at every stage of the design, we cannot help thinking much better work can be produced. The completed design may differ materially from what the client had in his mind when he set out to engage his architect, but it is certain to be better. His essential requirements will havt been met and probably something more; it is even possible that economy has been secured by more skilful disposition.

Looked at broadly, a competition is a great waste of skilful effort. It is true the prize, or prizes, given may be of higher value than is the professional value of the individual design, or designs, to which they go. They never, or seldom, represent the professional value of all the designs submitted, and thus the client has received more than fair value for what he has given. He has called forth a large amount of work for his own benefit for which he has paid nothing and which is worthless for any other purposes, and has thus been the cause of much wasted labour. The difference between a competition and a lottery is, after all, but small; in the second the stakes are in money, in the first they are in labour. It is true that the one is a gamble whose success depends on chance, the other is one whose success depends on skill; but there are elements which handicap the skill of some of the competitors, and there is an element of chance in the decision of those who select the prize winners. If then there are any advantages in architectural competitions, they lie on the side of those who invite them; but we are speaking on the side of the competitors, and in their interests we feel that it would be well if competitions were abolished. Nothing of the kind prevails in any other profession, except in a very limited way in engineering, and the architectural profession would gain in dignity if it proscribed them.—Indian Engineering.

The Elements of Accurate Cost-Keeping[*]

By Edward Probert

THE introduction of a cost system will substitute accurate knowledge for guesswork, and will facilitate the adoption of more consistent policies. With accurate knowledge of conditions, there comes an incentive to excel them, and this is always a desirable condition of affairs.

Accurate costs will reflect fluctuations in the prices of raw materials, labor and expenses, day by day, week by week, year by year, enabling the management to meet competition intelligently, because, when preparing estimates, they have authentic data as a guide.

By analysis and comparison, the cost system will develop a knowledge of the weak spots in the organization, bringing them to the attention of the management, for the closer the transactions of a business are analyzed and sub-divided, the fewer opportunities there remain for leaks and waste.

The managing officer, through the cost records, can determine whether men or methods are rendering efficient service, and, by having definite figures showing the cost of each operation, each operation can be analyzed to see whether the cost cannot be reduced by a better method.

One reason why cost systems are not more extensively used, is that, to the uninitiated, they appear a mass of hopeless detail, yet, when fully understood, each detail is seen to be a vital important part of the whole.

Summarizing, the general advantages of a cost system are: (1), reduction of costs; (2), increased output; (3), introduction of machines to replace manual labor; (4), guide for future estimating; (5), basis on which to judge the efficiency of men and methods.

Uses of a Cost System.

Cost records should be made, not only for the purpose of determining profits after the job is completed, but also with the object of discovering opportunities for economy. It is not enough to know how much a job costs; it is most essential that the contractor should know why it costs as much as it does. Then, if the unit costs are higher or lower than on previous jobs, the records should enable the portion of the work in which the difference exists to be promptly and accurately discovered.

A cost system must be constantly used to be of any benefit. A contractor would not buy a steam shovel, run it on a spur at the job and expect it to remove the dirt without attention of any kind.

Some of the things a cost system should do are: (1), determine the labor, material and expense cost per unit on each class of work; (2), give a record of the man-hours per unit on each class of work; (3), show the condition of the work on each unfinished group; (4) show the total amount of direct and indirect labor on each job, and for what the indirect labor is used; (5), show total output, average monthly output, busy time, and idle time on each group, for day, week or month; (6), show operating cost per hour, and per unit handled, of each class of machine used; (7), show whether unit costs are increasing or decreasing; (8), reveal attempts to cover mistakes or weak conditions; (9), disclose wastes of time, of material and of expenses.

Elements of Costs

Costs cannot be determined by the use of exact mathematical formulae, such as are used in the solution of the majority of engineering problems. If five engineers or five hundred are asked to give the formula for maximum bending moment for a uniformly loaded simple beam of uniform cross-section, they would all concur in the statement $\frac{wl^2}{8}$, because the formulae for the investigation and design of beams are based on inexorable natural laws.

The various elements that go to make up the cost of a job, however, can be grouped under different headings and their relation to each other can be stated by the following approximate formulae:

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[*] Abstract of a paper prepared for The American Society of Engineering-Contractors.

Direct Labor + Material + Direct Job Expense = Job Cost.

Job Cost + General Expense = Cost to Construct.

Cost to Construct + Selling Expense = Total Cost.

Total Cost + or — Profit or Loss = Selling Price.

These are the main divisions, although, if a number of accountants were asked for their definitions, they would designate them by different names; for, unfortunately, the terminology of accounting has not reached the same degree of fineness as that of the other professions.

The items of time, material, and expense occur in every business, whether it is the making of needles or the building of a four track railroad from the Atlantic to the Pacific. The problem lies in tracing and apportioning time, material, and expense, which make up the total cost of doing business.

The mere grouping of items under general headings, however, is not sufficient. For instance, it is the practice of some contractors to promiscuously group under one heading all the items of labor, material and expense used in placing the concrete on an entire building job, then divide the total amount by the total number of cubic yards placed, and say that the concrete costs so much per cubic yard.

This does not give an intelligent cost. It does not allow comparison with other jobs, which have had more or less masswork, larger or smaller columns, beams and girders, richer or poorer concrete, different reinforcement and numerous other variable factors. Its use in estimating on future jobs would be accompanied by misgivings as to whether the conditions on the new work are in any way similar to those on the old job. It is obvious that the above so-called "cost" would be of no value for use in estimating the cost of retaining walls, dams, or other masswork.

A specific instance of this came to my attention quite recently. The contract covered all the concrete work in connection with the erection of a new plant, to cost approximately $50,000. The work consisted of footings, foundations of various depths, a concrete reservoir, a concrete pit 25 ft. deep under the pump house, piers, machinery foundations, columns, etc. The contractor obtained the job at a low blanket price per cubic yard, which showed clearly the earmarks of "rule of thumb" estimating. After receiving his final estimate and selling his entire plant, the contractor managed to pay his labor and material bills, but had to borrow money to pay his railroad fare home, minus profit, minus plant, plus experience.

If this contractor had had dependable cost records, which would give unit costs, divided into labor, material, and expense, there would have been a different story to relate.

Devising a Cost System

The most important feature in devising a cost system is to see that it is peculiarly adapted to the individual contractor's business. It must be complete yet simple, exhaustive but not cumbersome, absolute and still flexible, and, above all, free from red tape.

In the designing of a thorough system, a knowledge of the fundamental principles of accounting science and some familiarity with its practice are necessary. Equally important are a knowledge of field work, a thorough study and analysis of conditions, a clear understanding of the essential features of the business and the manner in which the final results should be reported. Given these essential qualities, the best system will be one that is based on an extensive knowledge of the organization, operation, personnel, strong and weak points and aim of the specific undertaking for which the system is intended.

A cost system to be complete should include every item of expenditure connected with a job or jobs from the time that the bid is accepted until the final release is signed. It should be a complete and accurate record of actual transactions and should not contain data based on approximations, guesswork or speculations, for then it becomes only a process of recording human guesswork.

The system must be designed to fit in with the regular routine of the work and not, as is often the case, to handicap the work by trying to adapt it to the requirements of system, transplanted in whole or in part from what some other organization is using. One of the fundamentals upon which the total success of the system is dependent, is that it must be attuned to the particular needs of the organization. Too much emphasis cannot be laid upon this feature.

There are cost systems and costly systems, the first giving an abundance of useful data with comparatively little work, the latter giving comparatively little data with an abundance of work.

A system should be well balanced, i.e., the different classes of work should receive consideration according to their relative importance or their proportion of the total amount of the work. It is absurd to devote a lot of time to calculating the cost of some part of the work to one hundredth part of a cent, when the total cost of that work is only one-tenth of 1 per cent. of the total cost of the job, and then overlook the larger items, yet this is frequently the case. This misplaced concentration is not of recent origin, as is evidenced by the following extract from Rawlinson's Herodotus, the original of which was written about 400 B. C. Speaking of the Pyramids of Gizeh, he states:

"There is an inscription in Egyptian characters on the pyramid which records the quantity of radishes, onions, and garlic consumed by the laborers who constructed it; and I perfectly well remember that the interpreter who read the writing to me said that the money expended in this way was 1,600 talents of silver."

In a job which took 100,000 laborers twenty years to erect, the only item of cost considered worthy of handing down to posterity, was not the man hours, cost of transportation or the methods of construction, but the cost of the "radishes, onions, and garlic consumed."

Some systematizers advocate the practice of making the cost records an integral part of the general accounting records, others, especially engineers, argue in favor of a complete divorce of the two sets of records. Webster defines cost as, "The price, value or equivalent of a thing purchased; the amount in value paid, charged, or engaged to be paid, for anything bought or taken in barter. The word is equally applicable to the price in money or commodities."

It is evident, that the total cost of a job includes all the expenditures, both in cash or commodity, made or incurred for that particular job. These cannot all be determined by a system that is entirely independent of the general accounting system, and vice versa. There are many items that cannot be accurately entered in the general records without a proper distribution having been made of them by the cost department. A system in which neither is entirely dependent upon the other, but in which both are interdependent, will give the best results.

It has been the general experience when cost systems are devised and put in operation without regard to the general accounting system, that their results, if good, are merely a matter of chance; frequently they are inadequate; and, generally, the system breaks down altogether. The main cause of failure is the lack of close connection with the general system, for where that system does not segregate those items which constitute the rightful material of the detail cost system, (and grouping all other items under their proper headings), the field is so indefinite that the cost department does not know what to include and what to exclude in making calculations; and there is no mathematical proof that all omitted items are included in the calculation of percentages to be added to direct cost.

Although a cost system should tie in with the general system, the costs should not be handled wholly from an accounting standpoint, but due consideration should be given to the engineering features involved. The only reason that the total of the cost records should check with the amount segregated by the general system, is to make sure that all necessary items are included.

A set of forms do not make a cost system. Forms are merely the vehicle of expression and a means of recording the present activities of the organization and preserving them for future reference. The forms that have proven of value to one contractor may be worthless to another one in the same line. There are no "standard" forms for any one class of work, but they should be designed to meet the conditions of the individual business, as the correct designing of the forms has much to do with the facility of handling the system.

The success of the system is not dependent upon the fact that the labor tickets are pink instead of yellow, or that the material requisitions are 4 in. x 6 in. instead of 5 in. x 8 in., or that the kind of work done is reported by a mnemonic code instead of a written description, although there are minor advantages to be obtained by the systematic use of forms.

Before a form is put into operation, its make-up should be carefully considered, not only in regard to the specific items that the form is to record, but in its relation to every other form in the system. Many systems are "form mad," i.e., the forms are so numerous and they so duplicate both useful and useless data, that the system degenerates into an incoherent mass of confusion.

Installing a System

One of the peculiar characteristics of human nature is to resist any change from regular routine. Consequently, in order to avoid friction, it is best, when commencing the installation of a cost system, to proceed gradually, taking each class of work separately and developing the reports for that particular part of the work, keeping in mind, however, the relation between that part and the work as a whole. As soon as one part has been analyzed and organized, take up the next one, and so on, enlarging the scope of the system, step by step.

Too many systems are installed without taking into account this "human equation." It is assumed that the men using them are reasoning, thoughtful and analytical. Patient work is required among the men in the different departments, in explaining to them the various workings of the system. If they do not understand it clearly, they become suspicious and look upon it as an indication of lack of confidence in their ability. The system should be put forth with the sanction of the highest authority and should not be allowed to interfere with the progress of the work.

No system, however good, will give immediate results. It must be established and must have run smoothly for months and even years, before the full advantages are released. For all progress is made by comparing what is being done to-day with what was done some time ago, and this can be done to any purpose only when the bases of comparison are similar. No spasmodic efforts at the introduction of new methods are of the smallest value.

To secure the nearest possible approach to accuracy in cost keeping, the records should be made at the time the transaction occurs and not weeks or months later. There are and will always be many questions as to the meaning and correctness of records that must be referred to the operating departments, and the time to do this is when the incident is still fresh in the foreman's mind. To be of final and real commercial and technical value, records must be continuous and extend over various fluctuating periods of trade.

Labor

Since correct cost accounting depends upon the correct measurement of direct labor applied, it is obvious that this measurement of time must be accurate and not subject to the desire of any employee to improve his efficiency record at the expense of facts. It is desirable that the keeping of time be done by some one in authority and not by the workman.

Inefficient timekeeping not only results in a sure loss of cash, but always bears with it a lot of consequent losses in the way of useless clerical labor, unreliable cost information, faulty efficiency records, padded payrolls, etc.

There are several different bethods of determining the wages that a workman is entitled to receive. The conditions of the work in question will determine the advantage of one method over another, and before any plan is adopted, those conditions should receive careful consideration.

Some of the most used plans, with their respective advantages and disadvantages will be discussed briefly.

First, there is the "day rate" plan, in which the workman is paid a certain rate per hour or day for being on the job. He stays on the job so many hours for so much money, the amount of or lack of work that he does depending upon the degree of control which the foreman possesses over him. Of course, there are exceptions to this, but they do not remain exceptions for very long, because as soon as they see that the others are getting as much pay as they are for less work, they slow down to the same pace. The advantages claimed for this plan are that it is the simplest and provides the easiest payroll to make up.

The total amount paid to a contractor for a job can be considered as divided into the number of payments for different classes of work—so many units of concrete, so many units of excavating, so many units of brickwork, etc. To be consistent, it would seem that the contractor should pay for the work done in the same manner, i.e., so much accomplished by the "day work" plan, which pays only for the number of hours spent on the job, irrespective of the quantity of work done.

To overcome this condition, the "piece work" plan was devised. Under this plan, the workmen are paid according to the exact amount of work done and their earnings are in direct ratio to their efforts and abilities. The solution of the question of the piece rates to be paid is one requiring great care and expert judgment. If the rates are set too high, the men will dig in and earn from two to three times their regular day work pay, and the contractor, feeling that he has been imposed upon while operating under the day work plan, will cut the rates. This causes dissatisfaction among the workmen, who will then work just fast enough to earn the maximum that they think the contractor will stand for without making another cut If the rates are set too low, there will be no incentive for the workman to exert himself, and as he will not earn as much as under the day work plan, he quits the job, which, when labor is scarce, is a serious matter for the contractor.

Therefore, as stated above, the question of rates should be made the subject of a careful investigation, so that they are equitable to all concerned. More rigid inspection is necessary under this plan, as the increased wages to be earned provide a strong incentive to haste and corresponding carelessness.

Another plan is the "premium plan" in which the increase in wages is based on the time saved on any particular work. The workman is given a fixed task, measured in quantity of work to be performed in a given time, and he receives as a bonus a certain percentage of the time he saves by performing the task in less time than allowed. This plan also pays a minimum wage per day, which assures the workman of a certain wage in case he fails to save time on account of conditions beyond his immediate control.

Any saving in time benefits both the employer and employee. To illustrate: a certain job carries a time allowance of 10 hours, workman to receive 50 per cent. of time saved; assuming that the wages are 30 cents an hour, the following conditions result:

Time Taken	Hours Saved	Hours Workman is Paid for	Labor Cost at $0.30 Per Hour	Workman's Wages Per Hour
10 hrs.	0 hrs.	10 hrs.	$3.00	$0.3000
9 "	1 "	9½ "	2.85	3.3167
8 "	2 "	9 "	2.70	0.3375
7 "	3 "	8½ "	2.55	0.3643
6 "	4 "	8 "	2.40	0.4000
5 "	5 "	7½ "	2.25	0.4500
4 "	6 "	7 "	2.10	0.5250

In addition to the above labor cost, there is a proportionate saving in overhead expenses, due to the increase in work turned out for the same daily expenses.

Under the piece work plan, the workman gets the benefit, the employer saving only on overhead expenses, while under a premium plan, both obtain benefits; the workman in increased wages and the employer in reduced labor costs and overhead expenses.

There are several other premium or bonus plans which are variations or combinations of the above.

When installing any wage system, a careful study should be made of the class of workmen employed, and that plan selected which seems best suited and that will produce agreeable relations between employer and employee.

The question of the apportionment of the cost of the material is a comparatively simple one, and the results obtained will be practically correct. The prices of material are affected by fluctuations of the market, but as most of the material for a structure is furnished under contract, these daily variations in the market price will not affect the costs.

The unit cost of the material should be the cost at the place it is used and should include all freight, express, dryage and other charges incurred for that particular material.

In addition to the money value,, the cost records should show the entire quantity consumed for any one piece of work. By entire, is meant the total quantity necessary to complete the work and not only the amount left in the finished work. For instance, in making forms, there is always a certain amount of waste in cutting, which must be included in the total amount shown by the cost records as necessary to make the forms, if the records are to be of any particular value.

The size of the job and the value of the material will determine the necessity of a storeroom and a set of stock records, although in all cases it would seem advisable to provide proper storage facilities. Most contractors keep an accurate check on their cash, and as material is the same as cash, in that they have been exchanged for each other, it would seem only proper that the material should be subjected to as careful supervision as the cash. When material is not properly taken care of, it is liable to misuse, unnatural depreciation, pilfering, etc., all of which increase the cost above that provided for in the estimate.

Depreciation

That a contractor may do business at a percentage below cost, discount his bills, meet his payroll promptly and maintain a good credit rating for years, without his books showing a dollar of loss, is a condition not generally recognized, but nevertheless true. This may seem a paradox, but the explanation is simple. The average contractor, working without a cost system, does not include depreciation of equipment among his items of expense. There are many other items that are easily omitted when the expenses are not subject to the rigid requirements of a scientific cost system. This accounts for the fact that many contractors who seemingly are working at a profit, suddenly find themselves with nothing but a worn out plant to show for years of effort. The moneys that have been considered as profits and paid out in dividends, should be in a sinking fund for the replacement of the plant when it is worn out.

The subject of depreciation is one that cannot be treated lightly. It is one of the most uncertain factors as far as absolute accuracy is concerned. The rates to use must fit the individual case, each item being given separate consideration. They should be so fixed that when the equipment or plant becomes worn out or obsolete, the jobs upon which it was used during that period have completely absorbed the original cost. An important point in this connection is, that the rates should not be based on the manufacturer's estimate of the life of the machine, but upon the period of usefulness to the contractor.

For instance, a manufacturer may claim that his machine will last 20 years: this would give a rate of 5 per cent. per annum, but in ten years, due to improvements in design, the machine may be so completely obsolete, that it would be folly to attempt to use it in active competition, although it may not be worn out. The depreciation of this item should have been figured at 10 per cent. per annum.

The importance of depreciation should be fully realized upon the installation of a cost system, otherwise the early profits will be overstated and a fictitious value placed upon the plant items in the balance sheet.

Points Respecting Reinforced Concrete*

By Arthur E. Collins, M. Inst. C. E.

THE ease with which the best shapes for any particular construction can be obtained in reinforced concrete has always made it a fascinating material to engineering and architectural designers. Its durability has been proved in many ways, including the life of reinforced-concrete houses built in Newcastle-on-Tyne half a century or more since. When the brick walls of the sea lock at Lowestoft were pulled down some years since the writer saw hoop-iron reinforcing taken out quite free from rust. It had been in position between high and low water for half a century or more; its condition was due to the protecting influence of mortar. All the reinforcing iron found was in equally good state. That reinforced concrete is reliable is shown by the large number of bridges, reservoirs, piers, wharves, sewers, and buildings of all sorts constructed of it and giving good service.

About fifteen years since, the writer constructed reinforced concrete floors in a large building he was then erecting. To obtain lightness he used furnace clinkers largely in his aggregate. His equanimity was much upset by the forward movement of the whole front wall of the building, four storeys high, upon the asphalte damp course, which investigation showed to be due to the presence of sulphur in the clinkers. resulting in expansion of cement in the concrete floors. The movement amounted to less than half an inch and did not continue, nor have the floors given trouble, but furnace clinkers have not been used since.

Care must be exercised all round. For instance, water flowing from woodlands containing vegetable extractives has a prejudical effect on cement. Aggregates, such as destructor clinker, containing free lime, are injurious. In his own work the writer has had concrete walls, pavements, steps, and other constructions injured thereby. Clinker, coke breeze, and other aggregates containing sulphur must always be avoided; they are destructive of cement. Some shale bricks contain sulphur, and old bricks of this variety are unsuitable for concrete aggregate.

The earliest use of reinforced concrete in road foundations known to the writer was by the President when engaged in road improvements in advance of tramway construction for the Middlesex County Council. In one of these roads the writer visited with him. the regrading necessitated a considerable depth of clay fill: to avoid the worst consequences of settlements he covered this with a reinforced-concrete raft. Upon recent inquiry the writer ascertained this had been successful.

Reinforced concrete is a most adaptable and suitable material for constructing manholes, underground chambers, etc., in unstable or water-bearing ground. The structures can be moulded in the dry and sunk to the required depths, necessitating the minimum of timbering and pumping.

For retaining and abutment walls, reinforced concrete is especially suitable, particularly where great width of foundation and weight are wanted, as in many dock walls. The walls can be constructed with flat-plate or deck foundations, of any desired extension, vertical flanges, buttresses or revetments, and weighting shelves moulded at the back of the wall so that the whole construction is monolithic. The soil removed in preparing the foundation can be filled in on the plate or deck foundation, and upon the weighting shelves at the back of the wall to provide the necessary weight.

The writer has used reinforced concrete largely in sewer construction and with great economy. There are considerable lengths of reinforced concrete gravitating sewage and surface water sewers in Norwich from 42 in. diameter down to 21 in. Some have been laid a quarter of a century. All have been entirely satisfactory: no repairs have been done to any of them, and they are as good as when laid.

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* Written for the Annual Conference of the Municipal and County Engineers, July, 1915.

Brick Production in the United States

A report will shortly be issued by the United States Geological Survey which will show that the value of brick and tile produced in the United States, during the year 1914, was less by $13,707,935 than the production of 1913. This is progressing backwards at the rate of nearly ten per cent. in one year.

The value of common-brick produced in 1914 shows a loss, as compared to 1913, of $6,365,233, or more than eleven per cent. in one year. According to the preliminary figures, it was the worst year in the recorded history of the department, the records going back to 1903 inclusive. In addition to the drop in the quantity produced, there was a drop in price—the average falling from $6.20 per M. in 1913 to $6.12 per M. in 1914.

Face-brick production fell off in value to the extent of about $324,515, as against 1913. This is a loss of only three per cent., and shows that face-brick withstood the pressure of competition and hard times better than its less aristocratic brother-in-clay.

Paving-brick is the only important clay product that increased its output in 1914, the gain being $362,345 or a little less than three per cent. better than 1913.

Fire-brick sustained a loss of $4,199,575. The value of the 1914 output was $16,427,547, while that of 1913 was $20,627,122. This is close to twenty per cent. The loss is due, it is said, to the almost complete stagnation of the iron and steel industries during the early months in the year.

The following wash is recommended as effective waterproofing for cisterns, silos and similar structures. A stock solution is made of 1 lb. lye, 5 lbs. alum and 2 quarts of water. A pint of this solution is added to a bucket of of water and 10 lbs. of cement, making a paint-like mixture to be applied with a brush. This is a modification of the Sylvester process and depends on the precipitation within the pores of the concrete of insoluble alum soap or alumina hydrate, or both together.

The hardest kind of steel may be drilled with ordinary drills by using a lubricant of one part of spirits of camphor and four parts of turpentine. Mix thoroughly and apply cold, allowing the solution to remain a short time before applying the drill. Run the drill slowly with fine feed.

The Wychwood (Toronto) Branch Library

REPRODUCED herewith is the design for the Wychwood (Toronto) Branch Library, prepared by Messrs. Eden Smith & Sons, Toronto. The reading room and library are 70 ft. long by 30 ft. wide. This portion of the building, which is raised 7 ft. above the ground level, is really a large hall, with an open timbered roof, the walls being 19 ft. high to the springing of the roof, and the ceiling 29 ft. at its apex. The stairs from the Bathurst Street entrance lead into this hall from under a gallery screen. At the other end of the room is a large stone fireplace. Bookshelves line the walls on each side to a height of about 8 ft. Above the shelving, all around the room, transomed and mullioned windows provide plenty of light. The wall between the windows will be finished in grey stucco.

Below this hall is the basement floor, which is ten feet in height.

An adaptation of the English Seventeenth Century Collegiate architecture was chosen for this building, because the plan of its requirements, the material, brick and stone, which were found most convenient to use, are not at all appropriate for a monumental building of Greek or Roman origin, such as are popular in many cities. The basement is to be faced outside with grey stone to the height of the main floor. The external walls above this will be of tapestry brick, and the detail work, doors and windows, transoms, and mullions, of grey stone, like the basement. The roof is to be covered with grey-green slate. The casements are to be glazed with clear glass in lead bars.

The proposed Wychwood Library.

Consistency of Concrete

IN a paper read before the Connecticut Society of Engineers, results are given of a series of careful tests made to determine the effect of varying the percentage of water in concrete. The principal conclusions of the author are summarized below.

The percentage of water has a direct bearing upon the strength of concrete. Nevertheless, it is the exception rather than the rule that the engineer concerns himself with the question of mixing beyond seeing that the proper proportions of sand, stone and cement are used and the contractor is generally allowed to mix these materials as he thinks fit.

In preparing the specimens for his tests, the author found it necessary, when making mixtures containing more than 27.5 per cent. of water, to increase the proportions 10 per cent. in order to fill the moulds. This indicates an increase in density which was obtained at a loss of strength. However, in some cases this is highly desirable. Often bulk and impermeability are the two requisite features. In reinforced concrete structures a moderately wet mixture is far more practical than a dry one; but it must not be forgotten that the use of wet mixtures increases the cost of materials. An increase in density means a corresponding increase in raw materials. The additional water weakens the concrete, and therefore a richer mixture or lower unit stresses must be used. The former is preferable, for the beams and columns in concrete building are always heavier than the corresponding members of steel or wooden structures.

If a wet mixture is used, the engineer should be cautious in permitting the removal of the forms at an early date. In some of the tests the wet mixtures were very slow to develop their strength. The use of such consistencies in practice would necessitate extreme care. It might be a month or more before the forms could be struck with any felling of security.

The question of consistency is not altogether a laboratory question. The increased cost of materials due to the use of wet mixtures may be more than balanced by the saving in placing; but the engineer should bear in mind that consistency has a direct relation to strength, and if he permits a wet mixture he should provide the same in his design. In any event he should control the details of the mixing.

The Coming Industrial Boom

A well-known firm of patent agents, writing to the Illustrated Carpenter and Builder, say that everything points to the probability of the advent of an industrial boom, which will eclipse all previous activities of a like character hitherto experienced in Great Britain, and in which inventions will play an unprecedented part. That this is not mere surmise is evidenced by the greatly increased number of applications for patents made by German inventors since the outbreak of hostilities, the number of such applications having steadily increased until at the present moment, it is significant to note, they are in excess of the number made by American inventors.

This unusual activity on the part of German inventors clearly shows that they foresee the great industrial boom after the war, and intend to be well prepared for it. It is for British inventors, therefore, to counteract this move on the part of the Germans, and to proceed immediately with the task of improving all classes of automatic labor-saving machinery and inventions relating to building equipment.

The inventors who have their inventions perfected, and ready to place before manufacturers at the end of the war, will reap the benefit, as British manufacturers, after Government orders cease, will be on the look-out for specialties, firstly to keep their increased plants going, and secondly to capture the markets which the Germans held prior to the war.

To make a permanent cement used for stopping leaks in steam pipes where caulking or plugging is impossible, mix black oxide of manganese and raw linseed oil, using enough oil with the manganese to bring it to a thick paste; apply to the pipe or joint at leak. It is best to remove pressure from the pipe and keep it sufficiently warm to absorb the oil from the manganese. In twenty-four hours the cement will be as hard as the iron pipe.

Problems in the Design of Reinforced Concrete Buildings

POINTS of special interest to designing engineers are contained in a discussion (in Concrete-Cement Age) of the queries propounded below. The subjects are taken up in order by Mr. A. C. Janni, who is Consulting Engineer for the New York Central, and by Mr. A. M. Wolf, Principal Assistant Engineer, Condrom Company, structural engineers, Chicago.

1. "Is it right to consider beams entering wall columns as continuous or partially continuous?
2. "Should the effect of eccentric loading on columns be considered?
3. "If a beam enters a wall column and is considered to be continuous or partially continuous, what effect does it have upon the eccentric loading of the columns?
4. "If a column is avowedly eccentrically loaded and no provision for this is made in the design should we consider entering beams as freely supported or consider them as continuous or partially continuous because of the monolithic nature of the construction?"

By Mr. Janni

(1) In general, a beam entering a wall column, or any other quasi-rigid long support, may be considered as continuous, or partially continuous, according to the conditions of the supported end of the beam.

If the supported end of the beam has such a length that the allowable adherence between the concrete and the reinforcement in this supported end is at least equal to the tensile stress in the steel arising out of the assumption of continuity, it is clear then that the assumption of a continuous beam for the end of a beam entering a wall column is legitimate.

It should be borne in mind, however, that no matter what the assumption is with respect to that supported, a certain part of the adherence between concrete and steel, in the supported end of the beam, must withstand the shear in the beam. This fact, at first, seems in contradiction with theory and a few words of explanation are perhaps necessary.

Let us suppose that in Fig. 1 AB is a beam supported at both ends and uniformly loaded; the shear diagram will be given by the line CD.

As in any section of the span the adherence between the longitudinal steel reinforcement and the concrete is proportional to the vertical shear in that section of the beam, it is plain that on the right of B, as well as on the left of A, the reinforcement should not have any tendency to slip, as there is no vertical shear in any cross-section of the supported ends of the beam.

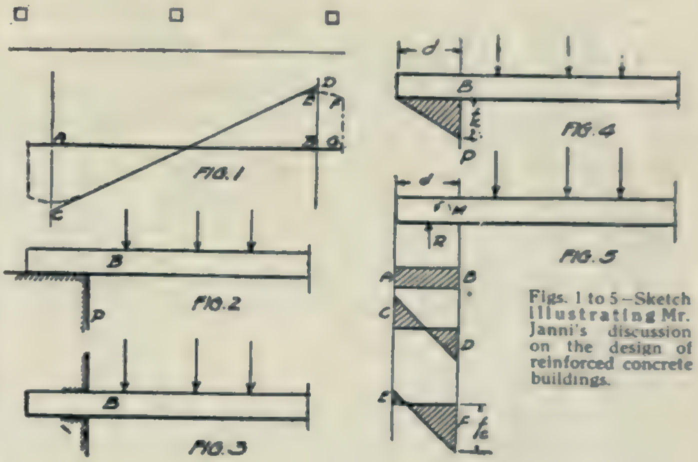
Tests, however, show that, while for limited efforts the theoretical formula holds good, this is not the case with higher stresses, even far below the breaking point of the beam.

The above phenomenon, apparently in contradiction of theory, finds its explanation in the fact that the modulus of elasticity of the concrete is not constant, but diminishes with the increasing stresses; so that, starting from a certain value of stress, the concrete begins to loose gradually its grip on the steel, which then finds a new position of equilibrium, extending its tensile action behind the vertical lines of supports.

The dotted line in the figure below should represent the diagram of shear. Incidentally it may be seen that the maximum actual shear is smaller than the theoretical one.

As said before, a designer, in assuming the hypothesis of the continuity of a beam entering a wall column, should take care first of the amount of shear shown by the diagram BEFG, and afterwards satisfy himself whether or not the remaining part of the allowable adherence is enough to withstand the moment due to the fixed end assumption.

Mechanical devices such as deformed bars, hooked ends properly made, etc., are, in a general way, good means of insuring the fixedness of that part of the reinforcement of the beam on the supports, while the vertical reinforcement of the column passing through the supported end of the beam insures its quasi-rigid connection.



Figs. 1 to 5—Sketch illustrating Mr. Janni's discussion on the design of reinforced concrete buildings.

Similar remarks may be made regarding the assumption of a partially continuous beam.

(2) The effect of eccentric loading on columns is an important condition of equilibrium, which should be investigated by the designer.

A column with eccentric loading is under the action of axial compression and bending; and specially for long spans carrying heavy live loads the compressive maximum stress may reach important values, the tensile stress in the steel doing likewise.

(3) A wall column being a column rigidly connected with the wall, no matter what the assumption of the beam entering the wall column may be, it has no appreciable effect upon the column itself.

In connection, however, with the idea of a beam and its supports, there is a certain point in the design of a beam entering a column, or a wall column, which is often overlooked by some designers; the point referred to is the investigation of stresses upon the support of a beam, arising out of the various assumptions made concerning the supported end of it, or in other words out of the reaction of the support.

A few words on this subject may not be amiss.

Let Fig. 2 represent the case of a beam with a supported free end, and Fig. 3 the case of a beam with a supported fixed end.

The distribution of the compression upon the support P, in Fig. 2, which is indeterminate, should be assumed, for the sake of safety, to vary according to a straight line, as shown in Fig. 4, the maximum compression fc being given by:

$$fc = 2 \frac{R}{b \times d}$$

where: R = total reaction,
b = width of beam,
d = length of the supported end of beam.

The case shown in Fig. 3 is never fully realized in practice; but the investigation of the stresses upon the support P should always be made.

This case may be represented as in Fig. 5, the reaction R being a compression and M the moment.

The diagrams to which each of these reactions give place are shown in Fig. 5; AB being the diagram due to the vertical reaction R (compression) and CD being the diagram due to the moment M.

Adding those two diagrams together, the total diagram EF is obtained, which gives the maximum fc, the value of which can be given also by the expression:

$$fc = \frac{1}{b \times d} R + 6 \frac{M}{d}$$

where the letters have the same meaning as above.

(4) A column, which, being eccentrically loaded, has been designed disregarding such condition of loading, is a deflective unit of construction, the conditions of equilibrium of which can hardly be improved by assumptions regarding the beam supported by it.

The assumption of a freely supported beam, while it is rightly made for the sake of safety, with respect to the beam itself, cannot be upheld with respect to its support, especially when this support is a column whose reinforcement extends vertically through the end of the beam and above it.

The prevented movement of the supported end of the beam during its deflection gives place to a moment, no matter whether or not the designer in his assumption took care of it.

Even if the reinforcement of the column does not extend in the beam end and above it (which would be another serious mistake) the friction between the top of the column and the bottom of the supported end of the beam is such that it would tend to deflect the column toward the span, during the deflection of the beam.

In either case, therefore, a bending moment is developed at the top of the column, which should have been taken care of.

The other two assumptions, namely, continuous and partially continuous beams, which are more proper for a beam entering a column, while they would result in economy, would not improve the conditions of the equilibrium of the column.

By Mr. Wolf

In the writer's opinion it is right and proper to consider beams entering wall columns as continuous or partially so, the degree of continuity depending mainly upon the number of spans in the building parallel to the beam in question, the reinforcement of beam and the size and location of column, that is, whether the latter is in an upper or a lower storey.

The degree of continuity to assume in beams cast monolithic with columns is dependent upon so many conditions that exact rules are impossible of formulation.

For example, a beam may be built monolithic with a wall column, but so little steel provided for negative moment at the column that when loaded the beam cracks at the top and the continuity is entirely destroyed and the beam becomes practically a simple span. It is apparent, then, that to have continuous action, steel must be provided in the top of the beam to care for the stresses developed. Just how to arrive at the amount of reinforcement necessary is a subject regarding which much has been written and as a result we have some bending moment formulas covering average conditions and which give safe results, and have been used to a considerable extent, and in addition are recommended by the Joint Committee. These are $Mwl^2/12$ at centre and at support for interior spans truly continuous and for end spans $Mwl^2/10$ at centre and adjoining support of end spans for both dead and live load under favorable conditions of fixity. For beams and slabs continuous moment is usually taken as $wl^2/8$ at central support and $wl^2/10$ near middle of span. (These moments, of course, being for uniformly distributed loads).

A beam is said to be fixed at both ends when the tangent to the elastic curve is horizontal over each support. Now a beam framing into a large lower storey exterior column which is relatively very stiff and unyielding will, if properly reinforced, be very nearly fixed, and it is evident that if steel is provided for a moment of $1/10\ wl^2$ over the supports and the centre the construction will be safe, for a coefficient of 1/12 applies to a fixed beam; and 1/8 to a simple beam, 1/10 being an average of the two coefficients.

Taking the opposite case of a slender top storey exterior column supporting a roof beam, it is evident that the conditions are by no means so favorable for continuous action, for more or less bending is sure to take place in the column and the conditions of support approach those of a simple beam. For this reason, then, little or no continuous action should be depended upon in exterior beams of roof construction where light columns are used; here again the judgment of the designer must be used in determining just what moment coefficient to use.

Some designers argue against reinforcing a continuous beam over the support for the full negative moment in accordance with the formulas given above, which are for beams with a constant moment of inertia, for the reason that the negative moment can be reduced by making the beam stiffer in the middle, or in other words, designing for an increased bending moment at the centre and a reduced moment over the supports. It has been generally accepted, however, from studies by Sanford E. Thompson and others that it is in general uneconomical to design a reinforced concrete beam stiffer in the middle than over the support. Sometimes, in order to comply with city building ordinances, it is necessary, in order to economize as much as possible, to design beams which tend to act as continuous for a lesser moment over the support than at the centre, as called for by ordinance; thus making allowance for the increased stiffness of the beam at the centre. Thus, for instance, if by ordinance a moment of $wl^2/8$ is specified at mid-span for continuous beams the steel over the support should be 6/10 of that at centre to have the beam act as somewhat continuous, and, at the same time, be as economical as possible in the use of steel. This practice is often followed, but truly continuous action is not obtained, even if the safety of the structure is not endangered. For truly continuous action to develop, it is necessary that the member be designed for the maximum theoretical moment which occurs over the support for uniform loading, and for a number of continuous spans uniformly loaded, this is -/12 wl^2. Now if less steel than is required by the above formula is placed over the support, the steel will be overstressed and cracks will tend to develop.

Some building ordinances sanction this practice by stating that the sum of the centre moment and that over support should be 1/6 wl^2 and that at least sufficient steel to fulfill the requirements of a moment equal to 1/18 wl^2 shall be used over the support. Such recommendations have led inexperienced and commercial designers to become "expert jugglers" of moments, making them whatever seem best to suit their needs. In fact, more faulty designs can be traced to this practice than to any other one cause.

It does not require much demonstration to prove that continuous action cannot be obtained by using a centre moment of 1/9 wl^2 and a moment of 1/18 wl^2 over the support (as the total moment of 1/6 wl^2 requires). In such a case the steel over the supports will be greatly overstressed and cracks will occur over the supports and the beam approach the condition of a simple beam, provided, of course, that the ends are supported. Finally, it can be said that it is impossible to obtain any desired distribution at centre and supports by the simple variation of reinforcement. The laws of mechanics govern these things, not the whims and desires of the designer.

The effect of eccentric loading on columns should be considered, but to arrive at a mathematically correct solution of the problem is practically impossible on account of the number of variables which must necessarily be considered. Ordinarily in buildings where the extent of the live load is very indefinite it will generally be found satisfactory to reduce the unit stress in exterior columns to, say, ¾ or 2/3 of the average unit stress used for interior columns, depending upon the type of construction, for to compute the stresses due to eccentricity for the great variety of conditions of loading which might occur is not justifiable. In structures in which a definite condition of live load is to be maintained at all times the effect of eccentricity should be carefully looked into. The best treatment of the subject of eccentric loading considerations on columns, in the writer's opinion, is found in Reinforced Concrete Design, by Faber & Bowie.

When a beam centres a wall column and is considered to be continuous or partially so, the result is that additional bending is thrown into the column, or, in other words, the eccentricity is increased, and provision should be made therefor in the design of the column.

In regard to the last question, this has practically been answered in the foregoing. If a beam is considered as freely supported and designed as such (there is no reinforcement placed in top of supports), the eccentricity on columns will not be so great as if the beam is designed as continuous or partially so. Therefore if no provision is to be made in column to care for the bending due to eccentricity, beams should not be designed as continuous or partially continuous at the support. This, however, is not good or economical design, for it would probably, in most cases, require no more steel to design beams as continuous and to strengthen the columns to care for the eccentric load imposed, than to design the beams as simply supported and not strengthen the columns. Reinforced concrete from its very nature tends to act as monolithic or continuous and therefore, wherever possible, advantage should be taken of this characteristic, for this is the distinguishing mark of the most advanced reinforced concrete design.

The C.P.R. Rogers Pass Tunnel

Progress on the Rogers Pass tunnel of the Canadian Pacific Railway has been very satisfactory. It will be remembered that this 5-mile double-track is being driven from intermediate headings reached by crosscuts from a pioneer tunnel or heading parallel to but outside the line of the main tunnel. The pioneer heading has been completed and there remain to be driven 2.05 miles of main heading and 3.31 miles of enlargement to the double-track section. The concrete lining of the earth section is nearly completed, and it is expected that the concreting of that portion of the rock section which requires lining will be finished during this year. The tunnel will probably be completed and ready for operation in September, 1916. The progress made during 1915 is given, from a statement furnished by Foley Bros., Welch & Stewart, the contractors. A C. Dennis is superintendent for the contractors.

	East End			West End		
1915	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track	Pioneer Heading, Ft.	Main Heading, Ft.	Enlargement for Double Track
January	592	443	443	932	699	210‡
February ...	620	440	422	650	634	247
March	595	196*	379	617	752	413
April	751	442	553	569	741	588
May	658	417	718	730	618	685
June	776	471	659	808	393	729
July	682	538	726	731	969†	812

*Half-month. †Two headings. ‡Timbered.

The contract for the first water storage project of the Streams Commission of the Province of Quebec was awarded recently. This development provides for a storage reservoir of a capacity of 160,000,000,000 cu. ft. The primary object is the regulation of the flow of the St. Maurice River. The contract was awarded to the St. Maurice Construction Company, Limited, at about $1,425,000, but it is reported that the actual construction will be done by Fraser, Brace & Company, Limited, Montreal, Que. The storage dam will be of the gravity type constructed of mass cyclopean masonry. It will have a total length of about 1,720 feet, a maximum height of 80 feet, and a width of 20 feet at the crest. The spillway portion will have a total length of 865 feet. The bulkhead section of the dam will be about 435 feet in length with a base width of 60 feet.

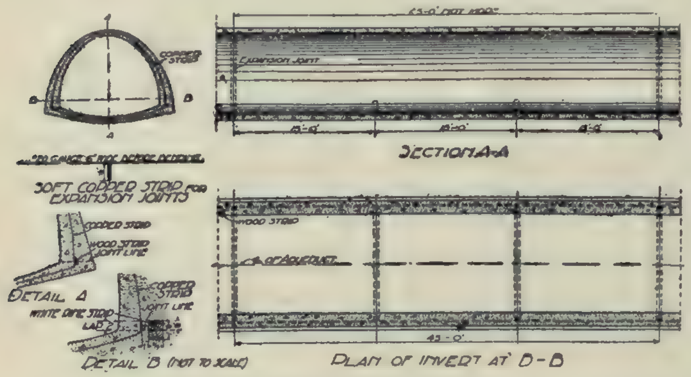
One of the recent developments in the way of builders' hardware is a screwless hinge which has two steel projections on each end. On the end next to the door stop there is a straight steel projection that enters the wood and on the other end of the hinge there is a clamp projection that enters the door casing. These projections or hooks counteract and offer the same resisting and holding force that the screw offers to the hinges. Besides doing away with the use of nails and screws, the statement is made that if gives the hinge a much neater appearance than those of ordinary construction.

Expansion Joint for Reinforced Concrete Aqueduct

THE accompanying illustration shows a form of expansion joint adopted by Mr. W. G. Chace, Chief Engineer of the Greater Winnipeg Water District, for a reinforced concrete aqueduct 84¾ miles long, with a capacity of 85 million gallons a day.

In the construction of this work, the invert is laid first in 15 ft. lengths, and between the ends expansion strips of 20-gauge copper, 6 in. wide, are placed, extending across the full width of the joint. East strip is bent along the centre to form a ½-in. offset, occurring exactly on the joint between the concrete surfaces. After the invert has set, the arch is moulded upon it in 45-ft. lengths, the joint joints being over every joint in the invert. In the 8-ft. diameter circular section of the aqueduct the expansion joints are spaced 30 ft. apart.

The fundamental idea of the joint is that the effect of contraction in the concrete will merely be to open the copper offset without tending to break the bond between the anchorage surfaces of the concrete and the copper. With the object of preventing any percolation through the horizontal joints between the invert and the arch above, strips of 1⅛ in. by ¾ in. white pine are built into the concrete throughout the length of the aqueduct, as shown at B, and care is taken to protect the joint until the concrete has thoroughly hardened.



Details of expansion joint.

Transverse Joints in Brick Pavements

IT has been customary in the past to provide both longitudinal and transverse bituminous expansion cushions in grout-filled brick pavements, but recent practice has demonstrated that the transverse cushions may be advantageously omitted if proper longitudinal cushions are provided. This is the opinion expressed by Vernon M. Pierce and C. H. Moorefield, of the U. S. Office of Public Roads. The principal objection to the use of transverse expansion cushions is based on the fact that the material composing the cushions frequently softens during warm weather and runs out toward the curb, thus leaving the edges of the adjoining brick exposed to destructive impact from the wheels of passing vehicles. Even if the cushion consists of a material which does not run in warm weather, it is necessarily softer than the brick, and the natural result is still the development of unevenness in its immediate vicinity. No such objection can exist concerning longitudinal expansion cushions, however, if they are placed adjacent to the curbs and constructed of proper material. They not only furnish a means for the pavement to expand and contract with changes in temperature, but they also eliminate to a large extent the disagreeable rumbling which has been so frequently associated with grout-filled brick pavements. The bituminous material of which the expansion cushions are made should be such as to remain firm in summer and not to become brittle in winter. It should also posses the quality of durability.

Expansion cushions should be provided for at the time the brick are laid by placing a board of the required thickness on edge adjacent to each curb. Small iron wedges may be inserted between the curb and the board at the time the board is set. These wedges may be readily loosened and removed after the bricks have been laid and grouted, and may consequently be made to facilitate the removal of the board.

The proper thickness for expansion cushions is a matter concerning which much difference of opinion exists among highway engineers. Some engineers advocate a minimum thickness of 1 inch, while others claim to have secured their best results by using expansion cushions having a minimum thickness as low as ⅜ in. for very narrow pavements. It is generally agreed that the thickness of the cushion should vary with the width of the pavement. The following suggestions for proportioning the cushion are offered as being fairly representative of the best practice:

For a 20-ft. roadway the cushion thickness should be ½ in., for 20 to 30-ft. widths, ¾ in.; for 30 to 40-ft. widths, 1 in., and for widths over 40 ft., 1¼ in.

Field Testing of Concrete

IN the past engineers and contractors have not been sufficiently concerned with the actual strength of the concrete entering into structures, says a writer in Engineering and Contracting, commenting editorially, they have been content to accept the results of laboratory tests of the cement and of a few samples of concrete, and have not given sufficient attention to the quality of the aggregates being furnished from time to time or to the methods used in mixing and placing the concrete. That the importance of these factors is being more generally realized is evidenced by the field tests which are being required on several important construction jobs now under way. That such tests are feasible and worth while can hardly be questioned, especially on jobs extending over a considerable period. The Massachusetts Institute of Technology buildings and the Welland ship canal are two important contracts on which field tests of concrete are required. In view of the fact that the engineers in charge of these projects have been compelled to originate their own methods of collecting samples of concrete and of testing these samples the following statements are pertinent:

On the Massachusetts Institute of Technology job two field samples are taken regularly on each section of the work at least four times a week for tests at 14 and 28 days, both samples being taken from the same batch. Wherever possible the samples are taken directly from place; but for beams, columns and girders, where this is impracticable, they are obtained from the barrow before placing. The concrete is shovelled into two 14-quart galvanized iron pails, remixed to eliminate any segregation of materials due to carrying from the work, and poured into iron molds embedded in moist sand. The maximum and minimum temperatures are recorded every day. For mass concrete, where the size of aggregate runs up to 2 or

2¼ ins., the samples are cast in 8 x 16-in. cylinders; but for the superstructure concrete, where the largest size of aggrgeate is not over 1½ ins., 6 x 6 x 12-in. prisms are cast. The bottom of each mold is formed of a ½-in. iron plate, and the concrete is tamped in the mold with a 6-in. ice chopper. Each sample is given one tamp on each face and four tamps at 90 deg. in the centre. The time given to dumping into the molds and tamping does not exceed five minutes. Just previous to the initial set the top surfaces are carefully trowelled with a plasterer's trowel to obtain a uniform bearing in the compression machine. After 48 hours the blocks are removed from the sand, taken from the molds, and reburied in moist sand until the day before they are tested. The following results of some tests made on this work are of interest: The average compressive strength of the 1:2:4 concrete at 14 days was 1,640 lbs. per square inch, while that of the 1:1½:3 concrete at the same age was 2,008 lbs. per square inch. At 28 days the average compressive strength of the 1:2:4 concrete was 2,110 lbs. per square inch and that of the 1:1½:3 concrete at the same age 2,520 lbs. per square inch—each value being the average of about 90 specimens. It is thus seen that the average increase in strength from 14 to 28 days for the 1:2:4 concrete was 23 per cent., while for the 1:1½:3 concrete this increase was 25 per cent.

The value of this system of sampling and testing was shown at the beginning of the job. Some of the test specimens of the 1:2:4 concrete gave low values, and the method of handling the concrete was changed at once, with the result that subsequent specimens gave proper strengths. The importance of making periodic tests of the aggregates was realized by the engineers in charge of this work, and an inspector was sent to the sand bank at regular intervals to obtain samples, which were sent to the laboratory for testing.

In building the concrete structures of the Welland ship canal it is required that field samples of concrete be taken during the progress of the work. These samples are made into beams 4¾ ins. wide, 3½ ins. deep, and 3 ft. long, for testing at specified ages. This work is being done at the field office of each section, the tests being made on a special machine designed for the purpose. This machine, which can be constructed at a low cost, has given satisfactory results.

On contracts which extend over a considerable period, field testing is a logical procedure, and we believe it will soon come into general use. The necessity of determining the quality of the concrete which is going into a structure has long been felt, and field testing will do much to insure a more thorough testing of the aggregates as well as better mixing and placing methods. The formulation of a satisfactory set of instructions is essential to the general adoption of field testing, and it is gratifying to note that a sub-committee of the American Society for Testing Materials has been assigned this work.

Reinforced Concrete Pavements and Roadways

By B. S Pease

THE subject of Reinforced Concrete Pavements and Roadways should receive special attention from consulting engineers, contractors, city officials and taxpayers for two main reasons. **First**, very little if any information up to the present time has been printed regarding this type of pavement either by the press, the engineering periodicals, or by local or national societies, and therefore full realization is given to the prospect of and the necessity for careful study and criticism of the opinions here expressed; **second**, the actual necessity for the use of reinforcement in concrete pavements in order to secure the proper results under varying conditions.

The subject of plain concrete pavements has been very carefully studied and the results of actual construction have received due consideration. It has been definitely shown that a pavement with a concrete wearing surface is low in first cost, gives but slight resistance to traffic, affords a good foothold even on grades up to 8 per cent., and its sanitary qualities and favorableness to traffic are of the highest quality. As to its maintenance cost, the limited experience shows that it is lower than any other type of pavement surface. As stated previously, a great deal of thought and discussion has been given to this form of a wearing surface for street and roadway pavements with the result that a decision has been reached as to the proper mixture, manner of mixing, quality of materials and methods of handling the same. There has been, however, a universal knowledge that there is one great objection to this material and that is, the natural tendency for the formation of cracks.

Assuming the proper mixture, construction, etc., there are three main causes for crack formation, namely, poor foundation, contraction during the setting period, and expansion due to temperature changes. The proper methods for improving the foundation are now standardized, but many times there are local conditions that make it impossible to follow such standards. In other words, the soil itself, either for natural or artificial reasons, may be of such poor quality that it is impossible to secure the proper results by any of these methods. The question then is, assuming their poor foundation, how to properly construct the pavement so that good results may be obtained.

It has been definitely shown that concrete will contract during the setting period, the amount depending upon the presence of moisture, the proportion of the mixture, and the temperature. It is the custom in specifications to state that the foundation shall be sprinkled prior to the depositing of the concrete so that the water in the mixture will not be absorbed by the soil. This is undoubtedly a very good precaution, but at the same time it does not absolutely prevent a loss of the water in the concrete. If this loss should be sufficient to reduce the amount of water below what is necessary to produce hardening by uniting with the cement, the finished construction is undoubtedly weakened; but in any event the less the amount of water, the greater is the amount of contraction. The results of tests show an average decrease in volume during the setting period approximately equivalent to a change due to a variation of 100 deg. of temperature. It is not necessary to argue the point regarding the change in volume due to temperature changes, it being only necessary to mention that such changes do occur.

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* From a paper before The American Concrete Institute.

Assuming that cracks do form in the concrete surface, what are the effects? Cracks formed by contraction will fill with dirt, grit, or other non-compressible material and prevent expansion at a later time when such expansion is necessitated by an increase in temperature. Therefore the beneficial effect of preconstructed expansion joints will be minimized; in fact this effect may be sufficient to entirely destroy the possibility of expansion.

The study that has been given to the proper construction of expansion joints shows that such joints must be protected to prevent the wearing away of there sharp and brittle edges by the action of wheel loads and horses' hoofs. If it is proper to say that the artificial joints will early show wear, is it not as proper to say that the same results will fillow for those joints that have been naturally formed due to natural causes? The final effect of these cracks in addition to being disagreeable to ride over and to their unsightliness, will be to very materially decrease the life of the pavement.

The next question to consider is how to prevent the formation of cracks in concrete pavements. Some have tried the plan of building the pavement in small units with expansion or contraction joints, but experience has shown that this method is expensive, unsightly and not durable. It has been conceded by those familiar with this construction that the joint even when properly protected by means of steel plates is the weak portion of the wearing surface and that it is here where the surface will first break down and show deterioration. Another means of prevention or rather a means of taking care of cracks that have formed is to fill them with an asphalt preparation, the object being to prevent sand or other hard substances from entering the joint and, in addition, to give at least a partial support to the sharp brittle edges. This method requires a certain amount of expense, the protection to the edge of the joint is questionable and the result is unsightly, at least for city pavements.

The Use of Reinforcement

The more recent method for the prevention of cracks is to use reinforcement of a sufficient amount and properly placed, depending upon the conditions. So far as can be determined reinforcement was first used in a concrete street pavement in 1910, and the results obtained since then certainly warrant consideration by those interested, which is the case as shown by the rapid increase in the number of municipalities that have constructed pavements of this type. An examination of available records will show that in 1910 two municipalities in one state used reinforcement in their concrete pavement, while in 1913 at least 56 municipalities in 15 different states contained construction of this type. One and two-course construction has been used in about equal proportions.

In regard to the necessity for and the effect of the use of reinforcement, consider those pavements that will be laid on a foundation of questionable quality. The necessity for the use of a reinforcement to give structural strength to the slab is evident regardless of whether such foundation is poor in spots or whether the entire area shows unsatisfactory conditions. If the foundation consists of filled material, it is almost impossible even by the use of a heavy road roller to secure a foundation that will not settle at some future date. As it is impossible to determine how much and where such settlement will take place, the logical suggestion is to use reinforcement so that the pavement will act as a unit and in this way prevent the formation of the destructive cracks.

If it is impossible to properly drain the foundation, thus allowing accumulation of moisture, the results will be disastrous if no reinforcement is used. During a rainy period water will accumulate near the outer edges, the pavement will settle under traffic loads because of this softened condition and cracks will form first in the top surface. During freezing weather the soil will expand because of the presence of water, thus raising the outer edge and causing cracks to form at the lower side of the slab, and to prevent these cracks reinforcement should be placed as near to the bottom as possible and yet secure sufficient protection to preventrusting.

This latter condition, however, is one that can and should be guarded against by proper drainage, and it is not the intention to advocate the use of reinforcement to take the place of proper drainage when such construction is possible. Therefore the only logical reason for placing the reinforcement at the bottom of the slab is to add structural strength to the slab placed over filled ground that cannot be properly compacted by methods that are or should be familiar to all engineers.

In the construction of country roads the width will usually be such that a part of the metal will extend outside of the old beaten track and therefore the foundation will be more compact under the center portion, even if the center be scarified and re-rolled it will be almost impossible to secure a uniform result. This condition in itself will allow a settlement at the outer edges and cracks will form longitudinally unless suitable reinforcement is used near the top of the pavement.

Owing to the absence of sufficient strength in the concrete during the setting period, it is impossible to conceive how a movement of the pavement over the foundation because of the contraction of the setting cement is to be accomplished. This being the case the assumption naturally is that the concrete contains thousands of invisible cracks which will decrease its strength unless a reinforcement is included to prevent such cracks from opening up to any extent. When a pavement contracts because of a reduction in temperature, cracks will form at more or less regular intervals, the distance between such cracks depending upon the tensile strength of the concrete. It is for this reason that many engineers advocate a certain definite and close spacing of expansion joints. At the same time they concede that these joints are the weak spots in the pavement; therefore if some other method of construction could be used so that the number of these joints can be reduced, such a method should receive consideration. As concrete in itself has no dependable tensile strength, it is necessary to include a reinforcement to supply this deficiency. For several reasons the practice has been to place this reinforcement near the top of the slab.

For a two-course pavement the logical position is between the base and wearing courses where it will not only resist expansion and contraction of the entire slab but will also act as a connecting link between two bodies of concrete having a different mixture of the ingredients, and in addition it will prevent the formation of cracks along the crown of the pavement where experience shows cracks almost invariably form in pavements that are not reinforced.

For single-course work the reinforcement is usually placed about two inches below the surface. Although this type is called single-course, it of necessity must be placed in two courses or layers in order to include the reinforcement.

Amount of Reinforcement to Use

The amount of reinforcement to use may vary with conditions, some of which must be determined by the engineer at the time, but a careful study of existing reinforced concrete pavements with special reference to the amount of reinforcement used shows that it is possible to specify the amount required in the average construction without knowing all the conditions. For country roads if the expansion joints are placed not to exceed 30 ft. centres, a reinforcement having a sectional area of metal of at least .049 sq. in. per ft. of width crosswise, and .038 sq. in. lengthwise of the pavement, will furnish sufficient resistance to prevent cracks due to shrinkage during setting, expansion or contraction from temperature changes, or to any ordinary inequality of the foundation soil.

The subject of proper spacing of expansion joints should be studied in connection with the reinforcement for the reason that the greater the spacing of joints the greater should be the amount of longitudinal reinforcing metal.

Past experience points to the fact that the principal change in the length of a concrete pavement is a contraction and although the metal has approximately the same coefficient of expansion as concrete and therefore will change in length about the same amount as the concrete, it will prevent the total shortening effect from being localized at definite intervals and will distribute the total change into innumerable small and invisible cracks that will not decrease the wearing qualities of the finished pavement. If the expansion joints are spaced at a greater distance than 30 ft. the amount of longitudinal reinforcement should be increased to at least 0.1 sq. in. per ft. width for spacing up to 100 ft. It is believed that by the addition of a sufficient amount of longitudinal reinforcement, it would be possible to construct the roadway without any expansion jointswhatever.

For street pavements the early practice was to use a very light reinforcement, but the more recent ones have made use of a heavier material even for close spacing of expansion joints. In fact the tendency now is to increase the weight of reinforcement, and since this item is small in comparison to the total cost of the finished work, it would appear to be poor economy to use a light material when for a slight additional expense a proper construction can be assured. The average cost for the reinforcement in place ready for concreting varies from $.07 to $.15 per sq. yd., depending upon the weight of reinforcement used. The same recommendations and the reasons therefor that have been given for necessary reinforcement for country roads will also apply to city pavement with the exception that regardless of the weight of reinforcement used, expansion joints will be required at all street and alley intersections or wherever connected with any permanent rigid construction.

In order that the reinforcement shall give the best results, the various members of which it is composed should be closely spaced so as to give a proper distribution of the metal. The metal should also have a high tensile strength and should be low in cost of installation.

Gravel is about the only hard-surfacing material Iowa has, and an experienced two-course water-bound road 1¼ miles long of that material will be built this year in Webster County just east of Fort Dodge. The road is for the purpose of testing out the gravel along modern lines to meet hard-surfacing conditions. It is to be a joint affair participated in by the city, county, State Highway Commission and the good roads section of the Engineering Experiment Station at Iowa State College. The road will be 16 ft. wide, 8 ins. thick in the centre and 16 ins. at the sides. Frequent tests will insure the proper proportions of gravel and clay binder. A coat of oil will probably be applied one or two months after construction has been completed.

The Inspection of a Building Job

"One of the great problems which the contractor has to face," says Leonard C. Wason, in a paper read before the Boston Society of Civil Engineers, "is that of the inspector who represents the engineer on the work. A thoroughly competent inspector is a great help to the contractor and very beneficial in the results obtained; an incompetent one is exactly the reverse." Mr. Wason points out some of the important qualifications which the ideal inspector must have—an even temper not easily ruffled, a considerate yet firm attitude, always diplomatic and capable of performing his duties acceptably to his employer.

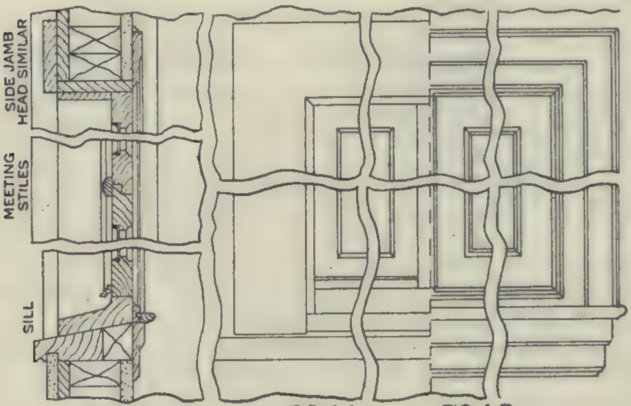
"The superintendent for the contractor is necessarily better informed and better trained in construction—an executive who is constantly directing others and is quick to resist, for the good of the service, insubordination or usurpation of the duties for which he is held to strict account by his employer. Trained to be an autocrat, his temperament does not take kindly to being bossed by another man admittedly with less experience."

It is evident that the inspector must not consider it a personal affront when his orders are overruled. He will make some mistakes which the engineer will correct—many more which his chief will never hear about, although they make unnecessary expense and may affect his chief's professional reputation. He is put in a trying position, the most frequent cause of friction in other men. His most common mistake is in giving the workmen orders direct. It is only by following his own duties and those alone that satisfactory results are obtained and the expense of the job kept within limits.

Over 51,000,000 gal. of water were used during 1914 in Milwaukee, Wis., in an effort to clear the water mains of an accumulation of sand carried into the system during forty years of operation. A special crew, under the supervision of the superintendent of water mains division, was engaged for several months, and the mains were flushed at 577 different points, the total amount of water used being nearly 35,000,000 gal. In addition to the work done by this special flushing crew, considerably more flushing than usual was done by the hydrant inspectors and mains-repair crew, which brought the total amount of water used to nearly 52,000,000 gal. While considerable deposits were removed in this way, a large number of meters were "sanded," and a considerable number of complaints of dirty water were received, owing to the fact that the flushing was done during the day and the house services used while the water was in a state of agitation. Accordingly it has been recommended that the flushing hereafter be done at night while the house services are inactive.

Detailing of Frames for Modern Residences

MANY of the more pretentious residences of the present time are built of hollow-tile and stuccoed on the outside. Owing to this hollow-tile wall, the window frames must necessarily be constructed in a somewhat different manner than are the frames for a brick wall, says John Wavrek, Jr., in The Woodworker. Having come in contact with various makes of these frames, it seems to me that a description of some of them would be of interest.



SECTION FIG. 1-A FIG 1-B

Dormer window with casement sash swinging inward.

There is a tendency at present to have most of the second and third floor inside finish in white. Where this is the case it is desirable to use basswood or poplar trim, which is very suitable for a white finish. The pulley stiles, however, should be made of some harder wood; yellow pine is used very extensively for this purpose. In order to show the inside finish alike it is necessary to construct the frame so that this result is obtained. In the sketches herewith several different kinds of trim are shown as applied to modern buildings.

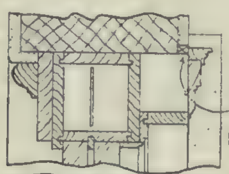
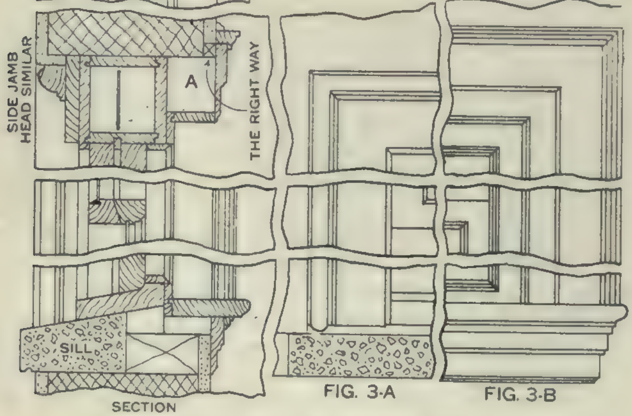


FIG. 2



SECTION FIG. 3-A FIG. 3-B

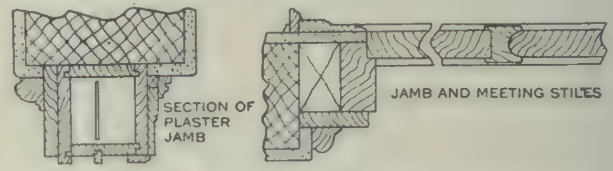
Window frame for hollow-tile wall.

Fig. 1 shows the method of building a dormer window having casement sash which swing inward. The discussion of this particular frame in various journals, from time to time, has no doubt resulted in producing a good casement frame. When the sash is hung on hinges at the sides, so as to swing outward, it is an easy matter to construct a water-tight frame, comparatively speaking. But there is an objection to such a frame, for it is unhandy in case it is desired to put a fly screen on the outside. The dormer frame shown is designed to fulfil this requirement. The sash swing inward, and the method of construction is such that the frame gives good satisfaction. Fig. 1-A shows part outside, and Fig. 1-B part inside elevation.

Although the casement frame is used quite often (and it has some features which appeal to most people), the double-hung frame possesses several advantages over it, and for my part I very much prefer the latter. But since the casement frame is still with us, and no doubt will be for some time, it is well to make it in the best possible way.

In Fig. 3 is shown a double-hung window frame of special make, designed for a hollow-tile wall with stucco finish outside. Fig. 3-A shows part outside, and Fig. 3-B part inside elevation. Owing to the large size of the sash the frame requires a large weight-box. In this case the reveal on the inside is 6¾ in. from wall line to jamb.

Fig. 2 shows a faulty inside trim as it was actually done on a job which we furnished a short time ago. The inside casing was plowed as shown, and naturally the trim had no support to which it could be nailed. Of course, blocking could have been provided whereon to nail it, but the contractor objected to this extra work. The result was that we plowed the casing farther back, and thus overcame the difficulty, as shown at A, Fig. 3.



Window frame for bathrooms, etc., and section of French window.

Another style of inside finish is shown in Fig. 4. In this case the jamb is plastered to the weight box of the frame; the small wall mould takes care of any inequality in the plastering. This style of window frame is suitable for bathrooms, toilets and bedrooms.

The French window frame is also extensively used in the better class of houses. The make-up of the frame is of the same design, practically, as the door frames. The sash, which are usually in pairs, have the meeting stiles made in various ways, either rabbeted or with an astragal joint, as shown in Fig. 5. I hope that this article will be instrumental in bringing up a discussion on the important subject of frames for modern residences.

The amount of polish which can be given to the surface of concrete depends upon the density and the nature of the aggregate used. After the surface has been smoothed down on a rubbing bed, or by the use of rotary rubbing stones, as applied in terrazzo floor work, the procedure is somewhat similar to that used in polishing granite or marble. The aggregate exposed on the surface by the rubbing process takes the polish, the appearance of the surface being dependent upon the percentage of aggregate exposed.

One-Course Method Reduces Asphalt Patching Costs 15 Per Cent.*

IN the repair of the ordinary sheet asphalt pavements which consist of a binder course and wearing surface the usual methods of using the two courses in making repairs has always seemed to me unnecessarily expensive, necessitating as it does the making of one operation in laying the binder course, and then going all over the work again in putting on the wearing surface.

In a day's work of repairing asphalt pavements, the ground covered frequently extends over several blocks, and in the case of repairing cuts made by the installation of public utilities in the newer paved districts, the repair work may extend over miles in a day's work. This not only makes two operations for the street crew, in fixing each cut, but causes an increased plant expense in handling the larger sized material aggregate for the binder course during part of the day, and then changing over to the finer aggregate for the wearing surface.

Every superintendent familiar with asphalt repair work realizes the difficulty in estimating the amount of material required for just the right amount of top or binder for a day's run on patch work, and therefore it is often the case that the plant foreman will prepare more binder than can be used or run the risk of not having enough. To repair sheet asphalt pavements by the "once over" method I have used in our work here for some time past an asphaltic concrete mixture of the following amount of asphaltic cement and mineral aggregate, and have had most excellent results with the same.

Asphaltic Mixture for Patch Work

	Per Cent.
Asphaltic cement	9
Mineral filler passing through 200-mesh sieve	5
Sand passing through 80-mesh sieve	10
Sand passing through 40-mesh sieve	25
Sand passing through 10-mesh sieve	15
Crushed rock passing through ¼-mesh sieve	26
Crushed rock passing through ½-mesh sieve	10

Screens used in the order named.

The cut or worn place in the pavement to be repaired is prepared in the usual manner by cutting away the defective material until a good joint can be secured in the sound pavement and then carefully trimming the edges of the cut and painting with pure hot asphalt. If the patches are unusually large or located on a grade where there might appear to be danger of the patches creeping on the base, I paint the concrete base with a hot asphaltic paint consisting of 80 per cent. asphalt and 20 per cent. distillate, and then proceed to fill the holes as prepared above with the hot asphaltic concrete mixture the same as is done with sheet asphalt, using special care in tamping and smoothing the joints and securing the maximum amount of compression by rolling, and finally dusting with cement.

It is well to have the mixture to be used fairly hot, at least 300 deg. Fahr., in order to secure thorough compression by tamping and rolling.

This method might appear objectionable on the grounds that the patches made with the asphaltic concrete mixture would plainly show in contrast to the sheet asphalt pavement. However, this is not the case, and a few days after the patches are put in they are not distinguishable from the original pavement, and by this method I have been able to decrease our cost of maintenance from 15 to 20 per cent.

Railroad construction at night is made possible, says a scientific journal, by the use of a freight car as a lighting plant. Projecting from a tower built at one end of the car is a light arm that extends far out over the track. At the extreme end of this arm two searchlights are placed, while other lamps are located at intervals along the arm. By means of this arrangement plenty of light can be shed upon the portion of the track that the arm overhangs, while beams of the searchlights can be cast ahead where the work of preparing the roadbed is under way. The lighting plant permits of carrying on work in the cool hours while the torrid sun is below the horizon.

Tests of Fireproofed Wood

At the recent annual meeting of the National Fire Protection Association, the Committee on the Uses of Wood in Building Construction presented an extended report dealing with tests made of wood treated with various fire-retarding compounds at the Government Forest Products Laboratory in Madison, Wis. These tests were made under the direction of Robert E. Prince and included also tests of the relative inflammability of various species of wood untreated and of various paints claimed by their manufacturers to have a fire-retardant effect.

The conclusions arrived at as a result of the tests may be briefly summarized as follows: The widely held idea that certain kinds of lumber are much more resistant to fire than others was not supported by the results of Mr. Prince's tests. It should be said, however, that his tests were made on the soft woods such as are in general use for building construction. It is of course recognized that the hard woods are less easily ignited than the woods from most evergreen species, but this is not a fact of practical importance, since the hard woods are generally unsuitable for exterior use.

Turning to the tests on lumber fireproofed with various chemicals, it was found that some of these chemicals injured the strength of the wood or discolored it, and had a corrosive effect on the cylinders used for treating. The best results in fire retardation were obtained from wood treated with ammonium salts and sodium borate. These chemicals are obtainable at prices which are not a serious handicap to the use of wood treated with them. The fire-retardant paint tests showed that a number of these paints have considerable value in decreasing inflammability, especially those which are designed for interior use. Extended tests were made also with various methods for reducing the inflammability of shingle roofs, and it was found to be practicable to effect this by various methods at a reasonable cost.

In an excellent paper on "The Protection of Ancient Buildings," prepared for the Annual Conference of the Institution of Municipal and County Engineers, Mr. W. A. Forsyth, F.R.I.B.A., gives a valuable summary of the various means at the disposal of the architect for the purpose indicated. The advantages of cement grouting receive due recognition and reference is also made to the aid that can be rendered by reinforced concrete in the repair of masonry and brick work.

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* By F. N. Bingham (Spokane, Wash.) in the Engineering Record.

Cost of Brick Pavement

THE cost of a brick pavement may be determined roughly by a formula given in a bulletin published recently by the United States Department of Agriculture. The cost of such a pavement, it is pointed out, depends so much upon so many variable factors, such as the locality, freight rates, and the distance from brick kilns, that it is not possible to make any definite estimates. The cost of the rough grading, however, should be considered entirely apart from the cost of the pavement, for the grading would have to be done no matter what kind of a road was to be built. Excluding this item, the bulletin furnishes the following formula as a rough guide for the probable expense of a brick road with a 6-in. concrete foundation and suitable grades: Cost per square yard equals 1.90 L plus 0.213 C plus 0.138 S plus 0.157A plus 0.040 B. In this formula C equals cost of cement per barrel, S equals cost of sand per cubic yard, A equals cost of coarse aggregate per cubic yard, B equals cost of paving bricks per 1,000, and L equals cost of labor per hour. It is assumed in this formula that all materials are delivered on the work. About 10 per cent. should be allowed for wear on tools and machinery, and for every inch subtracted or added to the thickness of the foundation there will be a corresponding difference of 8 to 12 cents per square yard.

Novel Method of Excavating for Caisson Foundations

THE methods and equipment used in constructing the caisson foundations for a bank building in Stockholm, Sweden, proved so effective and were so unusual as to warrant special mention by our Chicago contemporary, Engineering & Contracting. At one side of the building site the depth to bedrock was only about 10 ft. The rock surface shelved rapidly, however, and at the opposite boundary rock was encountered at a depth of about 60 ft. below the street level, or about 45 ft. below the ground-water level. The subsoil consisted principally of water-bearing sand and gravel, mixed with clay and boulders, in which the flow of water was so great that it was practically impossible to pump it. Moreover, it was deemed unsafe to lower the natural water level on account of endangering the foundations of adjacent buildings. To meet these conditions the following methods were devised:

Sectional caissons of reinforced concrete were constructed, circular in form, each section having an inside diameter of 7 ft., a height of 2 ft. 8 ins., and a thickness of 5 ins. The sections were provided with marginal recesses and with cored holes, through which passed the vertical rods used to fasten the sections together. The lower section, which was 6 ft. high, was provided with a steel cutting edge and with a steel lining, to protect it while the rock surface was being levelled by blasting. In excavating the subsoil within a caisson the material was loosened with a water jet and was removed through a suction hose, both of which were operated from the bottom by a diver. The excavated material was delivered through the suction hose and through a centrifugal pump into a settling basin, from which the water was drained off over a weir and conducted back through a flume, to the caisson. Where large stones and boulders were encountered they were hoisted, but stones as large as 4 inches in diameter were brought up in large quantities through the suction hose and pump. To facilitate the sinking of the caissons the motor-driven air compressor, used to furnish air for the drilling machines, was set up on top of a caisson as the latter was being sunk. The compressor vibrated considerably and the results obtained by its use in this manner were very satisfactory. After the caisson reached bedrock, the surface was levelled, by drilling and blasting, and the caisson was filled with concrete, deposited under water.

The contractor in charge of this work reported that the methods adopted proved both rapid and economical. We believe that equally satisfactory results can be obtained in many part of this country. The use of similar methods in constructing the foundations of bridges and buildings, especially in water-bearing soils where there is likelihood of a settlement of adjacent structures, should prove both effective and economical.

Personal Mention

Mr. George Henderson has been appointed president and general manager of Brandram-Henderson, Limited, in succession to his father, the late Mr. Joseph R. Henderson.

Mr. J. R. Macleod, who for some years has been in charge of municipal railways and tramways for Montreal, has now been given charge of the sewers department of that city.

Lieut.-Col. A. E. Hodgins, who has been connected recently with the British Columbia Department of Public Works, is organizing a corps of Royal Engineers in British Columbia.

Mr. G. R. G. Conway, M. Inst. C. E., M. Can. Soc. C. E., late of Vancouver, has opened offices at 409 Royal Bank Building, Toronto, for consulting practice in civil and hydraulic engineering.

R. H. Murray, A. M. Inst. C. E., Resident Sanitary Engineer for the Province of Saskatchewan, has received an appointment with the Overseas forces under the British Army Medical Corps. He sails for England on August 28th.

Mr. Murray Stewart, Roadway Engineer in the Toronto Works Department, was presented with a handsome set of silver last week on the occasion of his marriage. The presentation was made by Mr. William Barber, head of constructural operations, on behalf of the employees of the Roadway Department.

Mr. H. S. Philips has been granted leave of absence from his duties in the City Engineering Department at Toronto to accept the position of Assistant Engineer in the Buffalo, N. Y., office of the International Joint Commission, under the direction of Prof. Earle B. Phelps, of the United States Public Health Service. A part of the work of this Commission is the investigation of a means for the control of the pollution of the Niagara River.

The following civic corporations and Montreal contractors, engineers, builders' supply, and allied firms have intimated to employees intending to enlist that their positions will remain open until their return:—Cities of Montreal, Westmount, Outremont, and Maisonneuve, National Brick of Laprairie, E. G. M. Cape, Limited, the Pedlar People, Limited, Canada Cement Company, A. Ramsay and Son Company, Brandram-Henderson, Limited, the Garth Company, Canadian Consolidated Rubber Company, Canadian Fairbanks-Morse Company, Robert Mitchell Company, Canada Paint Company, Alex. McArthur Company, C. H. Johnson and Sons, Limited, Miller Bros. Company, Limited, Asbestos Manufacturing Company, and Geo. W. Reed and Company.

American Manufacturers Honor Canadian

A number of leading American manufacturers, such as the Winchester Repeating Arms Company, the Yale & Towne Manufacturing Company, the Pillsbury Flour Mills, Armour & Company, and thirty-six others of equally high standing, members of an organization known as the Rice Leaders of the World Association, have conferred a high honor on one of Montreal's business men. Rather more than a year ago, they offered nearly 3,500 cash prizes for ideas and suggestions. This was open to anybody, and the ideas and suggestions could relate to production, sales, advertising or anything else. The object of the offer was to develop suggestions that would tend to improve the methods or products of these American manufacturers. Only one idea could be submitted to each manufacturer, no two ideas could be alike, and each idea had to be compressed into fifty words.

Thousands of Americans entered this contest, together with a few Canadians, Britishers and foreigners. The Second Prize of $500 cash has been won by a Canadian, Mr. R. W. Ashcroft, of Montreal, Manager of Publicity for the Canadian Consolidated Rubber Company, Limited, and associated companies.

In presenting him with the prize, Mr. Elwood E. Rice, President of the Association, wrote Mr. Ashcroft as follows: "To have earned this Second Prize in this international competition where people in all walks of life from all parts of the world entered, is certainly a great evidence of your unusual ability, and in which you are indeed justified in taking exceptional pride. I extend to you my best wishes for the continued success your able efforts so richly deserve."

This is not only a feather in Mr. Ashcroft's cap, but is also a compliment to the business ability of Canadians, particularly in view of the fact that Mr. Ashworth only heard of the contest a few weeks before it closed last May, and therefore had but very little time in which to compile and submit his ideas.

No special publicity was given to the contest in Canada, so that those resident in the United States, who had a whole year in which to evolve ideas, naturally had a better opportunity than Canadians to compete successfully.

The Steel of Canada Company has been making remarkable headway in shell-making, according to official advices. Orders obtained by the company from the Shell Committee called for something like 650,000 shells, and out of the 605,000 delivered to date rejections only amount to the insignificant number of 62, making an almost perfect showing for the plant. Why the officials are particularly pleased with the result is that it was only in February that they started on the erection of the plant which is being used for the manufacture of shells, and the entire plant is manned by the company's own men, who have turned from their ordinary work to the special lines that are now being required.

Pedestrian traffic is now passing through the new Main Street subway, under the railway track, at Moncton, N.B., the work having been practically completed. Messrs. Soper & McDougall, the contractors, have made rapid progress with the work, considering the bad weather they have had to contend with during the summer.

Aztec Company's Important Contract

The city of Montreal has awarded a contract to the Aztec Oil and Asphalt Refining Company of Canada to supply and apply Aztec asphalt road binder, on the penetration method, for surfacing in the neighborhood of 300,000 yards of roads, all to be completed this season. Although the Aztec Company's price was slightly higher than some of the other bids, the company were awarded the contract after a test of a sample submitted to a committee of four experts for test in competition with samples from other manufacturers. This committee was composed of Dr. Milton Hersey; Mr. Crossley, of the Donald Laboratories; Mr. French, of McGill University; and Mr. Haynes, of the Polytechnic School. Mr. Paul Mercier is the acting chief engineer of Montreal. The Aztec Company are equipped with the necessary pressure distributors to complete about 5,000 yards per day, and have guaranteed their work for two years. Several thousand tons of this material are used yearly for similar work throughout the United States with highly satisfactory results.

Mr. A. W. Ashcroft, of Montreal.

Mainly Constructional

East and West From Coast to Coast

J. H. Wallace and Company, Limited, Montreal, is a new company incorporated with a capital stock of $20,000, to carry on business as engineers, architects and contractors The incorporators include Messrs. K. Archibald, S. L. D. Harriss and R. McGillivray.

A report from St. Marys, Ont., says that plans are under way for doubling the capacity of St. Mary's cement plant, and it is believed that inside the next twelve months another cement plant will be started. A number of houses are also in course of construction here.

Of the larger jobs in prospect, mention may be made of two sheds, estimated to cost $250,000, to be erected in connection with the harbor development work at Vancouver by the Dominion Government. The buildings will be 700 feet by 80 feet in dimensions, of structural steel construction.

Latest reports from Vancouver tell us that the New Westminster five-million-gallon storage reservoir, which is adjacent to the present high level track, is now practically completed, and will provide an added safeguard against shortage on the upper levels of the city for fire protection purposese.

A new company has been incorporated at Montreal under the title of Hubert Villeneuve, Limitee, with a capital of $50,000, and will carry on business as contractors and builders. The incorporators are Messrs. H. Villeneuve, J. H. Carpentier, W. J. B. Johnston, Rodrigue Gauthier and Raoul Villeneuve.

The corporate name of The Marion-Osgood Company, Marion, Ohio, has been changed to The Osgood Company. For some time the firm used the trade name "Osgood" on their shovels, dredges, and other excavating machinery, and the change in name has been made in order to conform to this trade name.

Dr. Broadfoot has commenced work on the erection of his new 30 x 40 ft. elevator, near the leading platform on the C. P. R. spur at Redcliff, Alta. Excavating for concrete foundation and the erection of the engine house are now under way. When completed, the elevator is to hold 9,000 bushels, consisting of 9 bins with a capacity of 1,000 bushels each.

The claims against the city of Prince Albert, B. C., of the Ambursen Company and Walker & Company have now been settled for $70,500. In April last the two companies entered action against the city in connection with the La Colle Falls scheme, amounting to $100,000. After obtaining legal opinion the Council decided to negotiate a compromise settlement, which has now been completed.

In the British Columbia Appeal Court recently, McIlwee Brothers, contractors, of Denver, Colo., won their appeal for half a million dollars judgment against Foley, Welch & Stewart, contractors for the Rogers Pass Tunnel. The plaintiffs sued for $527,000 damages for alleged breach of contract. The trial judge in the Appeal Court allowed them only $30,000, but the higher court added approximately half a million to the judgment.

The first length of pipe of the Bathurst, N.B., water and sewerage system was laid recently by Mayor Michaud, with appropriate ceremony. A. R. C. Clark & Son, of St. John, N. B., are the contractors, and are now well ahead with the work. A modern trench digger is being used, and work is advancing rapidly with the aid of this machine. The engineer is Mr. T. H. Higginson, of Montreal, later appointed Consulting Engineer.

Welland, Ont., is fortunate in securing the first Canadian reduction plant to be started in Canada. It will be in operation, it is expected, before next November. The newly incorporated Canadian Zinc Company, owned by the Weedon Mining Company, has acquired a large industrial plant in Welland, and has entered into a contract with the Hydro-Electric for an initial allotment of 1,000 horse-power. This will make Welland's first electric smelting plant.

The corner-stone of the new St. Vincent de Paul Church, situated at the corner of Roncesvalles and Westminster Avenues, Toronto, has now been laid. When completed the structure promises to be a very beautiful one, being of Grecian architecture and built of Indiana and Queenston stone. The cost of construction is estimated at $80,000, and the building will be 60 feet wide and 160 feet long, with a basement 11 clear feet in depth. Completion is expected in October.

The year's programme of sewer construction at Regina is now completed, and the city has 67¾ miles of water mains, including storm sewers and 73¼ miles of water mains, including the supply mains from Boggy Creek. With the exception of some of the painting and the construction of the doors and windows, the large new rectangular filter bed at the disposal works here is also completed, and the travelling distributors are already busy scattering sewage on the rocks which comprise the bed.

The Montreal Builders' Exchange have sent a letter to the Mayor protesting against a proposed referendum on the subject of changing the city's form of government. The Mayor objects to the present system of Controllers, and is hopeful that a referendum will be favorable to his views. The Exchange oppose the taking of a vote because of the economic and financial disturbance caused by the war; because the acts of individual controllers are liable to be confused with the Board of Control system; because of the expense; and also because the congested state of the city's affairs is not conducive to a clear and intelligent handling of the question.

The month of July saw the completion of the pioneer heading at the Rogers Pass Tunnel on the Canadian Pacific Railway near Glacier, B. C. At the same time the greatest progress for the job in enlarging the main heading for double track was made; 812 ft. of the west end of the tunnel having been excavated and timbered during July. The largest month's progress of enlargement for double track on the east end, 726 ft., was also recorded for the month of July. The best progress on the pioneer headings was 808 ft. for June and 932 ft. for January, 1915, both made in the west heading. This last figure is the American record for progress in any sized tunnel. The best month's work in the east pioneer heading was 776 ft. for June, so that June was the high month for the pioneer bore, with 1,584 ft. of progress made in both headings.

Another Improvement in the Construction of Creosoted Wood Block Pavements

By many authorities on municipal engineering, wood block paving is regarded as one of the best existing, when its wearing qualities and the cost of laying it are taken into consideration. It is as smooth as sheet asphalt, it is noiseless, elastic and sanitary. It wears evenly and is easily repaired, but construction methods as they now exist have given it its share of disadvantages as well as other forms of paving. If laid close together the blocks form a surface that is so smooth as to be slippery on account of the oil that bleeds from them. Manufacturers are developing means of overcoming the bleeding trouble, but in wet weather the blocks are almost as slippery as asphalt. Then, too, the wood block pavement is often subject to severe displacement on account of the expansion of the blocks. This often causes the pavement to heave up from its foundation under the internal strains set up by the expansion, necessitating extensive repairs. Even under these adverse conditions this form of pavement is popular, and the city of Detroit awarded contracts for 145,000 yards of wood block paving recently.

The remedy for the slipperiness of the pavement and one which provides for the expansion of the blocks at the same time is the allowing of a space between each block, to be filled with a suitable material that will be easily compressed when the blocks expand. It is the question of facilitating the laying of wood blocks with even joints between each block to take the expansion filler that has been engaging the attention of wood paving block manufacturers for some time now. In one case the blocks have been milled with lugs on the sides, but in order to leave these lugs projecting beyond the body of the block it has been necessary to cut away a lot of the wood to waste.

Now another means of spacing the blocks has been brought out by a Walkerville inventor, Mr. Harry E. Warden. The fundamental construction of this new type of pavement is illustrated in the accompanying sketches. By the use of the nails, which are about the size of lathing nails, there is no waste of wood in providing space between adjacent blocks. There is even a saving of wood, for it is unnecessary to have all the blocks machined down to one size. Arrangements have been made to get a machine that will drive the nails—at the rate of 80 a minute—to a set distance from the opposite face of the block. If the block is over size the nails will not project so far from the face into which they are driven, and if it is under size the nails will project further, thus making the size of each block the same when measured over the heads of the nails. This makes for a great saving in the cost of the lumber for the blocks, since lumber of millrun sizes is much cheaper than lumber dressed to size.

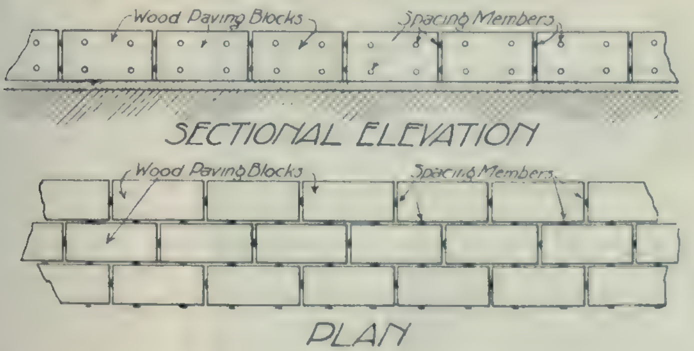


Fig. 1

Included in the patent covering this type of paving is a special shape of spacing member, which not only sets the space between the blocks, being driven in the same way as the nails, but also interlocks with corresponding members on the adjacent blocks. In this way any load applied to an individual block is distributed through the interlocking members to the other blocks comprising the finished pavement.

To prevent tar or other joint filling material from injuring the spacing members and making it difficult to repair the pavement or to use the blocks over again, a sleeve is provided to cover the spacing members, as shown in the drawing. This sleeve fits over the heads of either the nail or interlocking type of spacing member, so that it is impossible for any of the filler, whether cement or asphaltum, to come in contact with them.

The invention marks an important development in constructional practice in connection with wood block pavements. It overcomes what have been rather serious disadvantages of this form of paving; its slipperiness, which is done away with by the openings between each block, which provides foot hold for horses, and its liability to deformation, which is prevented by the strip of compressible material between each block.

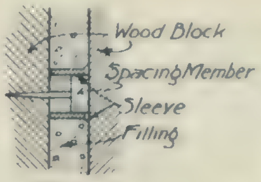


FIG. 3

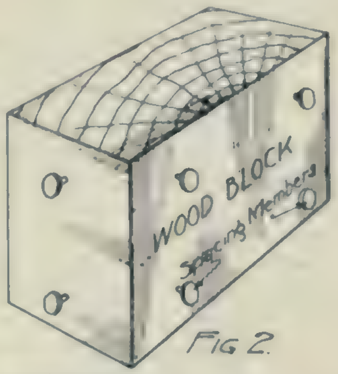


FIG 2.

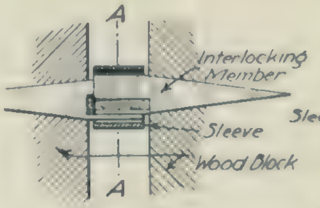


FIG. 4.

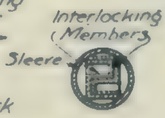


FIG 5.

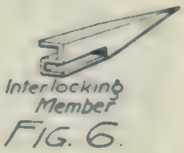


FIG. 6.

Tenders for Sheet Steel and Steel Bands

Hon. Phillipe Roy, Canadian Commissioner General at Paris, has forwarded to the Trade and Commerce Department communications from the Engineer of Equipment and Traction of the Paris-Lyon-Mediterranee Railway, with reference to the probability of Canadian manufacturers being in a position to tender for 600 tons of sheet steel, classes C, D, and E, for current uses, and 200 tons of sheet steel classes A and B, for boilers. Net prices are requested per 100 kilos for each of these classes of sheet and by thickness, the prices quoted to mean goods delivered free of all transportation charges, customs duty or other expenses, and loaded on cars in a station of the above mentioned railway system. A table, indicating the maximum simultaneous dimensions (length and width) which the Canadian plant can roll in various thicknesses is also asked for, together with the delays of delivery, which the company would undertake to observe.

The Paris-Lyon-Mediterranee Railway Company has also the intention of entering into a contract for the supply of 1,500 to 1,800 tons of steel bands, classes B and C, for locomotives, tenders, passenger and freight cars, which it will require during a period of six months. The deliveries of this item are asked to be made according to the needs of the Paris-Lyon-Mediterranee Railway Company on the dates indicated by them, and according to the special orders, which will be forwarded to the sellers two months in advance and which will indicate the types and number of steel bands to be supplied. Specifications and drawings for these tenders when received, may be inspected at the Department by Canadian firms, who may desire to do so. The date originally fixed for the closing of the tenders was July 31, but as the P.L.M. Co. has apparently not received sufficient proposals to meet its requirements, the time will in all probability be extended, in order to allow Canadian firms to compete. Further advices are being awaited from the office of the Canadian Commissioner General at Paris and any additional information will be referred to interested manufacturing companies, after its transmission to the Department of Trade and Commerce, Ottawa.

Underground Conduit Exhibition

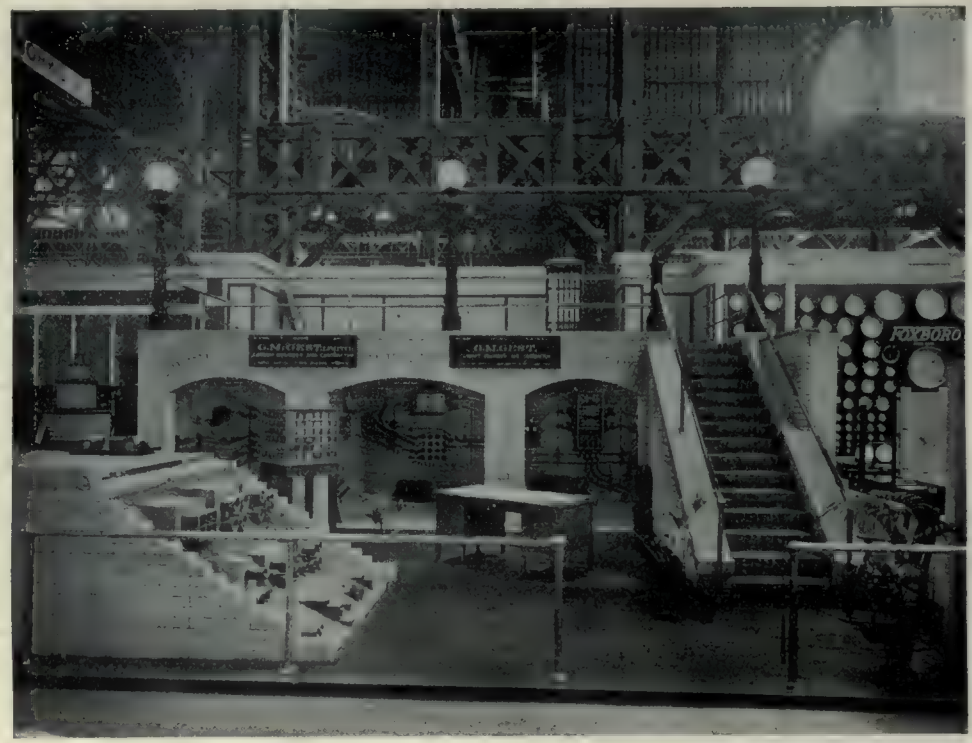
Among the Canadian exhibitors at the Panama Pacific Exposition at San Francisco is G. M. Gest, Limited of Montreal, Winnipeg and Vancouver. This exhibit while interesting to all, is instructive as well, and has attracted widespread interest, not only among those in electrical work, but also in everyone devoted to civic welfare. It has been the hue and cry in many cities to remove all overhead wires, and in this exhibit everything is shown pertaining to the underground which takes the place of the unsightly overhead.

Mr. Gest has made a specialty of underground conduit construction for many years, and has been identified with many of the largest installations of conduit and ornamental street lighting in Canada. In addition to the construction, Mr. Gest has done considerable engineering throughout Canada. Quebec, Montreal, Toronto, Ottawa, Winnipeg, Vancouver and Niagara Falls, have all benefitted by having this class of work installed by his organization. In most of these cities this organization has not only completed contracts for corporations, but for municipalities as well.

In recognition of what Mr. Gest has done in developing conduit systems, and for his methods of installation, the International Jury of Awards at the Exposition, has awarded his organization a gold medal, the highest award in his class. The exhibit, occupying about nine hundred square feet in the Palace of Machinery, comprises systems of underground conduit and cable construction, and shows the different materials, apparatus and methods of construction of the underground conduit and cable systems, and distribution systems wherein armoured cable is used. Everything for the distribution of electrical energy—light and power, signalling and communication—are presented in an attractive form. The various methods of installing underground conduit for draw-in systems are shown, including fibre, pump log, (creosoted wood) iron pipe, and clay conduit in both single and multiple, square and round bore type. Also methods employed in Europe including that known as the "trough system," using cast iron, asphalt and tile trough. Of the solid systems are shown armoured cable laid direct in the ground, also the Edison tube system.

Manholes are represented in telephone, light and power, also the transformer vault; these are in brick and concrete construction. Shown complete are the various forms of apparatus for the proper distribution of electrical energy for the several systems, such as transformers, junction boxes, cutouts, switches and cable terminals, all technically installed. In addition to the cable and other apparatus installed in the manholes are shown a street pillar and kiosk, also an ornamental lighting system with method of feeding, by means of underground distribution systems.

Augmenting the practical side of the installation of underground work described, drawings are shown of the plans for complete underground systems, also a collection of lantern slides, showing special features of construction, also lighting systems in various parts of this continent and Europe. As an exhibit, it is very interesting and instructive to all.



San Francisco Exhibit of G. M. Gest Limited.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Barrie, Ont.
The Town Council are about to construct a vitrified tile sewer on Mary Street by day labor. Engineer, C. K. S. Macdonell.

Dorval, Que.
A tar macadam road is being laid on Main Street by day labor, at an estimated cost of $30,000. Material has been purchased. Engineer, Z. J. Venette.

Enniskillen Township, Ont.
The Township Council have decided to enlarge and extend the Morrison Drain, and make repairs to others. Work will commence shortly. Engineer, G. V. Wyant, Petrolea, Ont.

Essex, Ont.
The Town Council contemplate laying concrete pavement on a portion of Center Street. Clerk, R. R. Brett.

Guelph, Ont.
The City Council have had plans drawn for extensions to the waterworks system. Work will include six spring basins, ten manholes, and the construction of a reinforced concrete reservoir. Approximate cost, $24,300. Engineer, F. McArthur.

Halifax, N.S.
The City Engineer, F. W. W. Doane, has completed surveys for a large quantity of concrete sidewalks, to be laid at an estimated cost of $71,400. Work by day labor. Wheelbarrows, shovels and a concrete mixer will be required.

Leamington, Ont.
Tenders will be received until September 6th by the Town Clerk, R. M. Selkirk, for the construction of a concrete pavement on Erie Street. Plans and specifications at office of the Clerk and of the Engineer, J. J. Newman, Ouellette Avenue, Windsor.

London, Ont.
The City Council have authorized the construction of cement sidewalks, curbs and gutters, asphalt pavements and gravel roadways on a number of streets. Clerk, S. Baker.

A by-law has been passed by the City Council providing for the construction of sanitary sewers on Quebec and Salisbury Streets, at an approximate cost of $3,300. The laying of a tile sewer on Inkerman Street has also been authorized.

North Vancouver, B. C.
The Municipal Council have instructed Engineer A. M. West to report on the construction of an 8-inch watermain on a portion of Seymour Street. Clerk, J. Cowlins.

Norwich North Township, Ont.
The Township Council have passed a by-law for the construction of the Burtis Perry Drain. Clerk, C. E. Burgess, Burgesville.

Peterborough, Ont.
The construction of cement sidewalks on Prince, Oxford, Donegal East and Dublin Streets has been authorized by the City Council. Engineer, R. H. Parsons.

St. Thomas, Ont.
The construction of a concrete pavement on Elgin Street has been authorized by the Town Council. Engineer, M. Ferguson.

Stratford, Ont.
The City Council are considering the construction of a sewer in Avalon Park and on Home Street, and the laying of sidewalks on Mowat and Birmingham Streets. Clerk, R. R. Lang.

Thorold, Ont.
The Town Council are about to construct sewers on Carleton, Lyndon and West Streets by day labor. Approximate cost, $3,300. Work to be done under supervision of the Resident Engineer, J. F. Henderson.

Toronto, Ont.
Tenders on the construction of asphalt pavement on Bloor Street west of Dundas and of a brick block pavement on Indian Road will be received until August 31st by the Board of Control. Plans at the office of the Works Department, City Hall.

York County, Ont.
County Engineer E. A. James, 57 Adelaide Street E., Toronto, is preparing estimates for the construction of about 25 miles of road work and a number of culverts in the northern part of the County.

CONTRACTS AWARDED

Barton Township, Ont.
The Township Council have let a contract for laying concrete sidewalks and curbs to Charles Brayley, Gibson Avenue, Hamilton. Approximate cost, $5,000.

Blenheim, Ont.
The Town Council have let the contract for the construction of concrete sidewalks to John Scoyne, Blenheim, and for curbs to T. E. Tifft, Blenheim. Estimated total cost, $4,000.

Dundas, Ont.
The Public Utilities Commission have let the contract for the construction of a storage dam at Greensville to the Dickson Building Company, King St., at $4,750.

Dunnville, Ont.
A contract for laying about 6,000 square yards of tarvia macadam paving and 4,000 feet of curbing has been let by the Town Council to McRae & Compaigne, Niagara Falls, at $10,460.

Edmonton, Alta.
The contract for the construction of a watermain to the site of the stockyards has been let to W. J. Graham, 82 Corey Street.

Leamington, Ont.
The contract for laying a sewer on Talbot Street has been let by the Town Council to Anson Smith, Chairman of the Board of Works. Cement or salt glazed tile will be used.

Lennoxville, Que.
Work has been started on the construction of a water system in connection with Bishops College. General contractors, Eastern Pipe & Construction Company, Limited, 128 Bleury Street, Montreal. Approximate cost, $5,000.

Port Elgin, Ont.
A contract for laying about 4,000 square feet of concrete sidewalk has been let by the Village Council to Thomas Brigden, at 7¼c. per square foot.

St. John, N.B.
The Municipality of the City and County of St. John have let a contract for laying sewers to Kane and King., Prince William Street, and for the supply of material to Vroom & Arnold, Robinson Building, Market Square.

York Township, Ont.
The Township Council have let the contract for laying concrete sidewalks on Markham Street and Westwood Avenue to the Riverdale Concrete Paving Company, 264 Jones Avenue, Toronto, and to William Bushell, 6 Westminster Avenue, Toronto, for sidewalk on Priscilla Avenue.

Railroads, Bridges and Wharves

Chatham Gore Township, Ont.
Tenders on the construction of a concrete bridge will be received until noon, September 2nd, by Commissioner W. Bidens, Lot 3, Concession 1, Wallaceburg. Plans and specifications with the Commissioner.

Nova Scotia Province
Tenders on the construction of a bridge and culverts in Victoria County will be received until September 4th by E. H. Armstrong, Commissioner of Public Works and Mines, Halifax. Plans and specifications at the Department, Halifax.

St. Catharines, Ont.
Tenders will be received until September 2nd by the Chairman of the Bridge Committee for 4,400 square yards of creosoted wood block pavement on concrete foundation, and 13,315 square feet of reinforced concrete sidewalk, to be laid on the St. Paul Street Bridge. Plans and specifications at office of the Engineer, W. P. Near.

West Nissouri Township, Ont.
The Township Council have authorized the laying of concrete floors on two bridges and repainting of several others. Clerk, J. H. Davis, Belton, Ont.

CONTRACTS AWARDED

Grey County, Ont.
The County Council have let the contract for the erection of bridges Nos. 1

and 3 to James Cole, Owen Sound, and for bridge No. 2 to Clark & Jones, Owen Sound. Concrete construction.

Haldimand County, Ont.
A contract for the construction of four concrete bridges has been let by the County Council to R. E. Duffy, Dunnville, at $3,977.

Huron County, Ont.
The general contract for the construction of a concrete and steel bridge between Goderich and Hullett Townships has been awarded by the County Council to Joseph Lawson, Crediton, Ont.

Public Buildings, Churches and Schools

Ashton, Ont.
The construction of the Anglican Church is nearing completion. Seating has not yet been purchased. Pastor, Rev. S. B. Holmes.

Clinton, Ont.
The erection of an addition to the Model School is contemplated by the Trustees. Approximate cost, $6,000. Secretary, C. D. Bouck.

Montreal, Que.
The Kensington Presbyterian Vestry are contemplating an addition to the Church in Notre Dame de Grace Ward. Frame construction, concrete foundation. Particulars from J. A. Veitch, 208 McGill Street.

Newcastle, N.B.
Tenders on heating, plumbing and electric wiring at the Miramichi Hospital will be received until August 28th by J. E. Edgett, Box 104.

Pembroke, Ont.
Plans of a Town Hall are being prepared by the Department of Public Works, Ottawa. Secretary, R. C. Desrochers, Ottawa.

Peterborough, Ont.
Tenders for alterations to the Y. M. C. A. building at 475 George Street will be received until August 28th by the Architect, W. Blackwell, 372½ Water Street. Separate tenders on plumbing and electric wiring will be considered.

Port Arthur, Ont.
Sundry repairs to the Municipal Buildings are being considered by the City Council. Work consists of repairs to roof and placing of steel columns in the Hall. Engineer, L. M. Jones.

Quebec, Que.
Tenders on the erection of a Grand Stand at the Provincial Exhibition of Quebec will be received until September 1st by Tanguay & Lebon, Architects, 20 d'Aguillon Street.

Smith Township, Ont.
The Township Council are about to issue debentures to the amount of $3,000 for building a school in Section No. 9. Clerk, J. W. Kelly, Bridgenorth.

St. Emelie, Que.
Tenders on the erection of a school will be received until August 30th by the Secretary to the School Commissioners, D. L. Filteau. Plans and specifications with the Secretary. Brick construction, concrete foundation.

Tecumseth Township, Ont.
Tenders on the erection of a school in Section No. 4 will be received until September 1st by the Secretary, John Harvey, Cookstown. Plans at residence of Barry Jebb, Newton Robinson.

Toronto, Ont.
A report has been presented to the Property Committee placing the cost of a new tile roof on the City Hall at $30,000. Property Commissioner, D. Chisholm.

Trenton, Ont.
Alterations to Grace Methodist Church, Dundas Street, are being considered. Brick construction, shingle roofing. Estimated cost, $5,000. Chairman of the Building Committee, H. E. Mayhew.

Vancouver, B.C.
The Department of Public Works, Ottawa, will call for tenders shortly on the construction of two large sheds on the new wharf. Steel and sheet metal construction, concrete base. Approximate cost, $250,000.

Winnipeg, Man.
In connection with the church being built on River Heights for the Presbyterian Congregation of St. Andrew's, contracts for plumbing, heating and electric work will be let by the general contractors, Grey & Davidson Company, Limited, Wall Street, Winnipeg.

CONTRACTS AWARDED

Belmont, Ont.
The School Board have let the general contract for the erection of a school to Horton Bros., St. Thomas, the contract for heating to Hamilton & Stott, 430 Talbot Street, St. Thomas, and for seating to the Globe Furniture Company, Shantz Avenue, Waterloo. Approximate cost, $7,000.

Compton, Que.
The general contract for the erection of an addition to the Town Hall has been awarded to D. Saultry.

Dartmouth, N.S.
A contract for the installation of fittings at the Post Office has been let to the Office Specialty Manufacturing Company, Sparks Street, Ottawa.

East Angus, Que.
The Department of Public Works, Ottawa, have let the contract for the installation of fittings at the Post Office to the Berlin Interior Hardware Company, 72 Wilmott Street, Berlin, Ont.

Elmira, Ont.
A contract for the construction of septic tanks at St. Paul's Church, Mill St., has been awarded to T. Rudow & Son, Elmira.

Elmwood, Man.
The contract for roofing at the new George V. School has been let to G. A. Glasgow, 532 Agnes Street, Winnipeg.

Fonthill, Ont.
The general contract for rebuilding Holy Trinity Church has been let to F. Grisdale, Thorold, Ont. Architect, D. F. Forbes, Temple Building, Welland. Approximate cost, $4,200.

Kelly's Cross, P.E.I.
The contract for galvanized iron work at St. Joseph's Church has been let to J. R. Wilson Company, Limited, Sydney Street, St. John.

Ottawa, Ont.
The contract for electrical work at Howick Hall, Exhibition Grounds, has been let by the City Council to the Rideau Electric Company, Bank Street.

Quebec, Que.
The roofing contract in connection with the foundling hospital in course of erection on St. Foy Road for the Bon Pasteur Convent has been let to E. Falardeau, Dorchester Street, the contract for plastering to G. A. Vezina, 61 Des Prairies Street, and E. Belanger, and for painting to Gauthier & Bros., 292 St. Joseph Street. Heating, plumbing and electrical work not let.

Romney Township, Ont.
The general contract for the erection of a school in Section No. 6 has been awarded to B. Blonde, 14 Cornhill St., Chatham. Smaller trades will be sublet. Approximate cost, $4,500.

Silver Lake, Ont.
The general contract for the erection of a school has been let by the Trustees of School Section No. 1 to Jenkins & Maurer, Kelso. Approximate cost, $10,000.

St. Albert de Warwick, Que.
Work has been commenced on the erection of a church for the Roman Catholic Congregation by L. Caron, Nicolet. Brick construction. Estimated cost, $18,250.

Victoria, B.C.
In connection with the observatory being built on Little Saanich Mountain for the Department of Public Works, Ottawa, the contract for ornamental iron work has been let to the Grandview Iron Company, 1685 Venables Street, Vancouver, and for electric work to the Hinton Electric Company.

Whitby, Ont.
The Board of Education have let the contract for roofing at the school now in course of erection to the general contractor, J. Pearson, Whitby.

Winnipeg, Man.
In connection with the school being built on Polson Avenue, the contract for heating has been awarded to James Ballantyne Company, Limited, Wall Street.

Wolfville, N.S.
In connection with the students' residence in course of erection at Acadia Collegiate Academy, the contract for roofing, plastering, painting and interior fittings has been awarded to the general contractors, Rhodes Curry Company, Limited, Amherst, the contract for heating and plumbing to Hagee & Company, Amherst, and for electrical work to G. Gormley, Wolfville.

Business Buildings and Industrial Plants

Carlton Point, P.E.I.
Tenders will be received until noon, September 8th, by the Department of Railways and Canals, Ottawa, for the construction of a station, water tank, engine house, transfer platform, standpipe pit and turntable. Plans and specifications with the Engineer, Car Ferry Terminals, the Chief Engineer, Moncton, N.B., and at the Department, Ottawa.

Embro, Ont.
Hugh McDonald, Huron and Commissioner Streets, is about to remodel business premises and install equipment for a general blacksmith shop.

Hensall, Ont.
The erection of an addition to the King George Hotel is being considered by Weir Atcheson. Approximate cost, $5,000.

Lobo, Ont.
Plans are being prepared for a store to be erected for Herman Marsh, Lobo Village, London, Ont., at an estimated cost of $5,000. White brick construction.

McGregor, Ont.
Thomas Imeson is considering the erection of fireproof farm buildings, at an approximate cost of $5,000.

Montreal, Que.
J. E. Desroches, 1621 St. Catherine St. E., is considering the erection of a store and four flats, at an estimated cost of $12,000. Work may be done by contract.

Ottawa, Ont.
W. E. Noffke, Plaza Building, Rideau Street, is preparing plans for an addition to a warehouse and office building on Slater Street for the Bate Realty Company, Slater Street. Concrete block construction, felt and gravel roofing. Approximate cost, $25,000.

Somerset, N.S.
Work will start shortly on the erection of a fruit house for the Somerset Fruit Company. Secretary, F. N. Illsley, Berwick, N.S. Approximate cost, $3,500.

St. John, N.B.
Plans for remodelling the Provincial Bank, Charlotte Street, are being prepared by H. H. Mott, Germain Street. Estimated cost, $12,000.

St. Thomas, Ont.
The St. Thomas Packing Company, Limited, may rebuild a portion of their plant, which was recently destroyed by fire. General Manager, J. Moody.

Toronto, Ont.
J. S. Playter, 176 Danforth Avenue, is building a garage at 184 Danforth Avenue, estimated to cost $3,500. Steel and brick construction, felt and gravel roofing.

The Toronto Hydro Electric Commission, 226 Yonge Street, are having plans prepared for a sub-station to be erected at St. Lawrence Market. Steel and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,000. Work by day labor.

G. W. Vesral, 61 York Street, proposes to erect an addition to his garage at an estimated cost of $4,000. Plans are being prepared by James Loudon & Hertzberg, 79 Adelaide Street E. Brick construction.

Welland, Ont.
Work has been started on the erection of a store and residence at State and Main Streets by Joseph N. Leon. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,500.

Winnipeg, Man.
In our last issue, we inadvertently published details with regard to a building being erected for the Bell Telephone Company of Canada. This information applies to the Bell Telephone Building now in course of erection at Sherbrooke, Que.

CONTRACTS AWARDED

Comber, Ont.
The general and carpentry contracts for the erection of a brick garage for William Keith have been awarded to G. Penie, 149 Lacroix Street, and the masonry contract to Moore & Stephens. Asbestos roofing. Estimated cost, $5,000.

Cornwall, Ont.
Robert Lalonde has let the contract for the erection of stores on Pitt Street to R. E. Ralph, Westboro, Ottawa. Terra cotta hollow tile and red brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000.

Edmonton South, Alta.
The general contract for the erection of a barn in the grounds of the University of Alberta has been let to Frost & Ingraham, 10164 108th Street. Frame construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

Hamilton, Ont.
The Frost Wire Fence Company, Sherman Avenue W., have let the general, masonry, carpentry, steel and roofing contracts for the erection of an addition to their factory to G. E. Mills, King Street E. Brick construction, concrete foundation.

Moncton, N.B.
A permit for the erection of a store has been issued to J. D. Creaghan Company, 795 Main Street. Estimated cost, $3,000.

Montreal, Que.
Work is under way on an addition to grain elevator No. 1, for the Harbour Commissioners. The contract for structural steel has been let to the Dominion Bridge Company, Lachine, the contract for carrying machinery to the Canadian Fairbanks-Morse Company, Limited, 84 St. Antoine Street, and for electrical work to Philip Lahee & Company, 20 St. Nicholas Building.

A. Claude, 196 de L'Epee Avenue, has commenced the erection of a store, estimated to cost $5,000. Contracts for roofing, heating and plumbing have been let to Lavigueur & Menard, 2483 St. Lawrence Boulevard, and for plastering to S. Rochon, 470 Outremont Avenue.

Ottawa, Ont.
The general contract for the erection of an agricultural building at the Government Experimental Farm has been let to W. Ashe, 214 Henderson Avenue, Ottawa.

In connection with the garage in course of erection on Sparks Street for Parks Dye Works, Limited, the contract for electrical work has been let to J. A. Davis, 21 Echo Street. Contracts will be sub-let for plumbing and heating.

Port Arthur, Ont.
The Canadian Northern Railway have let the general contract for the erection of sixteen pens at the stock yards at West Port to the Hearst Engineering Company, Port Arthur. Approximate cost, $10,000. Additional pens will be built later.

Princeville, Que.
Tenders on the erection of a slaughter house for the Co-Operative Abattoir Company will be received until noon, August 28th, by the Secretary, J. S. Picard. Plans and specifications with the Secretary.

Quebec, Que.
In connection with the store and residence being built on Canardiere Street by J. Carmichael, Notre Dame des Laurentides Street, the roofing contract has been let to L. Lajeunesse, 78 St. Agnes Street. Heating and plumbing not let.

Red Deer, Alta.
In connection with the warehouse being built on Gaetz Avenue for Nash Bros., Minneapolis, Minn., the masonry contract has been let to Schnurr Bros., the carpentry contract to the general contractors, Baird & McKenzie, North Red Deer, the contract for heating and plumbing to Smith & Gaetz, 58 Gaetz Avenue N., and for electrical work to the Western General Electric Company, 32 Gaetz Avenue S.

Sherbrooke, Que.
In connection with the office building in course of erection for the Bell Telephone Company of Canada, 118 Notre Dame Street W., Montreal, the carpentry, plastering and interior fittings contracts have been let to the general contractors, Anglins Limited, 65 Victoria Street, Montreal, and the contract for mill work to L. O. Noel, Lennoxville Road, Sherbrooke. Painting not awarded.

Somerset, N.S.
The general contract for the erection of a fruit house for Herbert Ayler, Kentville, has been let to J. H. Hicks & Sons, Bridgetown. Approximate cost, $3,500.

Sydney, N.S.
Work is about to start on the erection of a furniture factory on Charlotte Street for Wrights Limited. The general contract has been awarded to Frank C. Redding, North Sydney, at $25,000. Electric wiring not included.

Toronto, Ont.
T. R. Morris, 182 Bellwoods Avenue, is about to start work on the erection of a store and apartments at Danforth and Langford Avenues, and is receiving tenders on excavation. Masonry and carpentry by day labor. Other trades will be sub-let. Estimated cost, $5,000.

Work is in progress on the construction of a coal and chemical storage plant in connection with the Filtration System at Centre Island. General contractors, W. Cowlin & Son of Canada, Ltd., Mail Building. Approximate cost, $38,000.

Work is in progress on the erection of three stores and apartments on St. Clair Avenue W. for J. R. Gibson, 1228 St. Clair Avenue W. General contractor, J. Crang, 906 St. Clair Avenue W. Approximate cost, $10,000.

Whitby, Ont.
Work has been commenced on the erection of a repair shop and garage for W. J. Luke & Son, Dundas Street. The general, carpentry, steel, roofing, plastering, painting and interior fittings contracts have been let to J. H. James, Brock Street, and the masonry contract to T. G. Deverell, Brock Street. Heating and plumbing not let.

Residences

Blenheim, Ont.
The erection of a residence is contemplated by Thomas Smyth, Communication Road. Approximate cost, $3,500.

Dartmouth, N.S.
Tenders on heating, plumbing and electrical work at a residence being built on

(Continued on page 51)

Tenders and For Sale Department

Paving Tenders

Tenders are called for Reinforced Concrete Paving in the Town of Leamington, 1,840 ft. x 28 ft.; 400 ft. x 42 ft. Plans and specifications with R. M. Selkirk, Town Clerk, Leamington, and J. J. Newman, Engineer, Windsor, Ont. Tenders to be in by September 6th, 1915.

R. M. SELKIRK, Town Clerk,
Leamington, Ont.
34

Extension of Time for Wrecking Buildings

Order No. 1106

Notice is hereby given that the time for receiving tenders for the wrecking of buildings on the St. Paul Street Bridge right-of-way, St. Catharines, Ont., is extended until 5 o'clock p.m. of **Thursday, September 2nd, 1915.**

W. P. NEAR,
City Engineer.
34

THE QUEBEC STREAMS COMMISSION

Proposed Storage Dam on the St. Francis River

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tenders for Storage Dam at the outlet of Lake St. Francis," will be received at the Office of The Quebec Streams Commission, Room 264, Parliament Buildings, Quebec, until Twelve o'clock on **Tuesday, the 7th of September next (1915).**

Plans and specifications can be seen on or after this date at the said office or at the Quebec Streams Commission's Office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of Fifteen Thousand Dollars ($15,000), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into a contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, August 19th, 1915.

Newspapers inserting this advertisement without authority from the Commission will not be paid for it. 34-35

School Tenders

Sealed tenders, including a 5 per cent. marked cheque, will be received up to and including **Monday, August 30th,** by the Secretary of the School Board, Lambton Mills, in whole or in part, for the different trades required in the erection and completion of a school building. Plans and specifications and all particulars can be seen at Molson's Bank, Lambton Mills; also at the offices of the architects. No tender necessarily accepted.

THOMAS ELLIOT,
Sec.-Treasurer School Board,
Lambton Mills, Ont.
ELLIS & ELLIS, Architects,
Manning Chambers, Toronto. 34

To Contractors

Separate sealed tenders accompanied by a marked cheque for 5 per cent. of the amount will be considered at the Township Hall at 4 o'clock p.m., **August 30th,** for the following work in the Township of Logan:—

1. The repairing of the N. W. drain from concession 13 to near the junction of the Grey branch.
2. From concession 10 to the outlet.
3. The repairing of the McNaught drain.

Specifications may be seen at the Clerk's office, lot 16, concession 6. The lowest or any tender not necessarily accepted.

MARVIN LEAKE, Clerk,
R. R. 5, Mitchell, Ont.
August 13, 1915. 33-34

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, August 27, 1915

FOR

All Trades for New Building

Dovercourt School Grounds

Bartlett Avenue

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for 5 per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

W. C. WILKINSON,
Secretary-Treasurer.

MILES VOKES,
34 Chairman of Committee.

Tenders for Bridge Floor

Order No. 1105

Sealed tenders will be received, addressed to the Chairman of the Bridge Committee, City Buildings, St. Catharines, Ont., up to 5 o'clock of **Thursday, September 2nd, 1915,** for the construction of the Bridge Floor and Sidewalks for the St. Paul Street Bridge, St. Catharines, Ont.

Principal Items of Work

4,400 sq. yds. of Creosoted Wood Block Pavement, including Concrete Foundation.

13,315 sq. ft. of Reinforced Concrete Sidewalks.

Plans and specifications and forms of tender may be obtained at the office of the City Engineer. A certified cheque in the amount of $1,000 payable to the City Treasurer is required to be deposited with the bid and a construction bond of $3,000 shall be furnished the City by the successful tenderer to whom the contract is awarded.

The City reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the City.

W. P. NEAR,
City Engineer.
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CITY OF BERLIN

Province of Ontario

Sewage Disposal Works

Sealed tenders will be received by the City Clerk until twelve o'clock noon on

Tuesday, September 7th, 1915

for the construction of Sewage Disposal Works, comprising Tanks, Filters, Sludge Beds and Pumping Station.

Plans and specifications may be seen at the office of the Consulting Engineer, 204 Mail Building, Toronto, also at the City Engineer's Office, Berlin.

The lowest or any tender not necessarily accepted.

HERBERT JOHNSTON, Esq.,
City Engineer.
JOHN HESSENAUER, Esq.,
Chairman Sewerage Committee.
A. H. MILLAR, Esq., City Clerk.
CHIPMAN & POWER,
Consulting Engineers.
34

Fires

Kincardine, Ont.

The pattern shop of the Hunter Bridge & Boiler Company, Queen Street, has been destroyed by fire. Loss, $15,000.

Stoney Beach, Sask.

Fire has destroyed the store belonging to Hugh McGillivray, Pense. Loss on building, $1,200, and on the stock of hardware, $3,000, partially covered by insurance.

Portland Street for W. C. Bishop will be received until September 1st by the Architects, Harris & Horton, Keith Building, Barrington Street, Halifax.

Edmonton South, Alta.
A residence is being built on Fourth Avenue N. E. for Mrs. Catherine See. Work is being done by day labor under supervision of B. A. See. Frame construction, shingle roofing. Approximate cost, $5,000.

Hagersville, Ont.
Plans of a residence are being prepared for Edward Hannah.

Halifax, N.S.
The Eastern Investment Corporation, Cragg Building, Barrington Street, will receive tenders until September 1st on heating, plumbing, electrical work and interior fittings for residences in course of erection on Larch and Jubilee Streets.

Kent Centre, Ont.
Tenders will be received until August 30th on all trades required in the erection of a residence for Thomas Smith. Architect, S. G. Kinsey, Fifth Street, Chatham. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

Millville, N.S.
Work is about to start on the erection of a residence for Amos Hewen. Estimated cost, $3,000.

Montreal, Que.
Work on the erection of a cottage has been started by P. Blais, 462 Old Orchard Street. Estimated cost, $3,500.

J. R. Lavigneur, 273 Visitation Street, has commenced the erection of six flats on Beaudry Street. Estimated cost, $5,000.

Work on the erection of four flats has been commenced by T. Pageau, 337 Stadacona Street. Approximate cost, $7,000.

A. Lafreniere, 2400 Frontenac Street, is building three flats on Frontenac St. at an estimated cost of $3,500.

Ottawa, Ont.
The Oakland Land Company, care of W. J. Spratt, 157 Sunnyside Avenue, are considering the erection of a residence on Bellwoods Street, to cost about $4,500. Double brick veneer construction, stone foundation, shingle roofing.

Samuel Brooks, 69 Union Bank Building, contemplates the erection of a residence, estimated to cost $4,500. Double brick veneer construction, stone foundation, felt and gravel roofing.

Plans have been drawn for a residence to be built on Ossington Street for W. Ryder, 15 Maple Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,800.

Outremont, Que.
The cottages to be erected on Spring Grove Avenue for S. D. Joubert, 336 St. Catherine Road, will be built by day labor. Estimated cost, $17,000.

Port Stanley, Ont.
Oscar Smith, Colborne Street, has commenced the erection of a residence estimated to cost $3,500. Red pressed brick construction, concrete and stone foundation, shingle roofing.

Quebec, Que.
Quotations on all materials required in the erection of a residence are being received by R. Gosselin, 171 First Street, Limoilou.

Work has been started on the erection of a residence by A. Grenier, 74 Third Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $3,000.

Work by day labor has been started on the erection of a residence for N. Ferland, 410 St. Francois Street. Brick construction, concrete foundation. Approximate cost, $7,000.

Work by day labor has been started on the erection of a residence on Bougainville Street for Dame Marie R. Anctil, 56 Artillery Street. Brick and frame construction, concrete foundation. Approximate cost, $3,000.

E. Cloutier, 274 Canardiere Road, has commenced the erection of a residence on Tenth Street, Limoilou, estimated to cost $3,000. Work by day labor. Frame and brick construction, concrete foundation.

Renfrew, Ont.
W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa, is preparing plans for three double residences to be built here, and will call for tenders shortly. Tile and stucco or brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $10,000. Owner's name withheld.

Ruthven, Ont.
Guy Mills, Lakeshore, Ruthven, has commenced the erection of a residence, estimated to cost $3,000. Frame and white brick construction, concrete and stone foundation, shingle roofing.

Toronto, Ont.
The erection of a pair of residences at 128 Hope Avenue has been commenced by C. A. Drew, 119 Nairn Avenue. Smaller trades will be sub-let. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,500.

R. J. Marshall, 60 Rosemount Avenue, is building a residence at 7 Glenholme Avenue by day labor. Smaller trades will be sub-let. Brick construction, shingle roofing. Estimated cost, $4,000.

A residence, estimated to cost $4,000, is being built on Kingswood Road by A. Mundy, 43 Columbine Avenue. Brick construction, shingle roofing.

Work has been started by R. C. Naughn & Son, 4 Summerhill Gardens, on the erection of a pair of residences, estimated to cost $8,000. Brick construction, shingle, felt and gravel roofing.

Work on the construction of a brick residence at 1494 Dufferin Street has been started by R. J. Cole, 159 Ellesworth Avenue. Smaller trades will be sub-let. Approximate cost, $3,500.

F. Yetman, 997 Dufferin Street ,is building two residences on Hounslow Heath Road at an estimated cost of $3,800. Brick construction, shingle, felt and gravel roofing. Smaller trades will be sub-let.

Donnenfield Bros., 322 Clinton Street, are erecting three pairs of residences at 43-53 Dixon Avenue. Approximate cost, $15,000.

W. J. McWaters, 28 Kingswood Road, has commenced the erection of a residence on Neville Park Boulevard, estimated to cost $3,500. Smaller trades will be sub-let. Brick construction, shingle roofing.

Work has been started on the erection of a pair of residences at 6-8 Cuthbert Crescent by W. John, 1 Leeds Street. Brick construction, concrete foundation, shingle, felt and gravel roofing. Approximate cost, $6,000. Smaller trades may be sub-let.

W. P. Levack, 519 Roxton Road, is building a residence at 218 High Park Avenue, estimated to cost $4,000. Smaller trades will be sub-let. Brick construction, shingle roofing.

Work has been started by W. P. Levack, 519 Roxton Road, on the erection of a residence at 48 High Park Avenue. Smaller trades will be sub-let. Brick construction, shingle roofing. Approximate cost, $4,000.

A residence is being erected on Aziel Street by Robert McDevitt, 68 Medland Crescent. Brick construction. Estimated cost, $3,000.

Tenders are being received by D. S. Heritage, 43 King Street W., for all trades required in the erection of two residences at Danforth and Greenwood Avenue. Brick construction.

Trenton, Ont.
Frank Felion contemplates the erection of a residence on Queen Street, at an estimated cost of $3,500. Frame and pressed brick construction, concrete foundation, shingle roofing.

Wallaceburg, Ont.
Tenders will be called shortly on the erection of a brick veneer residence for C. M. Yates, Metropolitan Tower, New York. Architect, J. L. Wilson, 64 Market Building, Chatham.

Westboro, Ont.
Tenders will be called shortly on the erection of a residence for Charles Ogilvy, Rideau Street, Ottawa. Plans by W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa. Tile and stucco or brick veneer ronstruction, concrete foundation, shingle roofing. Estimated cost, $6,000.

CONTRACTS AWARDED

Barrie, Ont.
The contract for carpentry at the residence being built on Bradford Street by W. C. Thompson has been let to W. Gray, James Street.

The following contracts have been let in connection with the residence being built on Bradford Street by W. C. Thompson: masonry, F. Mayze; cement work, T. Tooke, 30 Grove Street; steel work, roofing and interior fittings, W. Gray, James Street; plastering, Thomas Thompson; painting, W. Barry. Heating, plumbing and electrical work not yet awarded.

Chatham, Ont.
The general contract for the erection of three residences on Hilliard Street for R. F. Mitchell, Fourth Street, has been let to T. Rayment, McKeough Avenue, the plastering contract to C .Wright, Wellington Street E., and the painting contract to W. Palmer, Adelaide Street S. Heating, plumbing, electrical work and interior fittings by owner.

Clinton, Ont.
Prior & Sweet have commenced the erection of a residence for W. J. Elliott, Victoria Street. The contract for carpentry has been let to J. Dayment. Concrete block construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

A residence is being erected for Mrs. Gilchrist, Rattenbury Street, by S. S.

Cooper. Frame and white brick construction, concrete and brick foundation, shingle roofing. Estimated cost, $3,200.

Dundas, Ont.

Work has been started on the erection of a residence on York Street by H. Grobb, 154 Dundurn Street, Hamilton. The masonry contract has been let to George James, and the carpentry contract to Martin H. Hewitt. Tenders on all other trades are now being received.

Halifax, N.S.

In connection with residences and flats in course of erection on Jennings, Jubilee, Lilac, Oxford and Vernon Streets for the Eastern Investment Corporation, Cragg Building, Barrington Street, the heating contracts have been let to Longard Bros., 213 Hollis Street, the plumbing contracts to W. S. Craig, 316 Upper Water Street, and electrical contracts to J. Starr Son & Company, Limited, Granville Street.

Work has been started on the erection of a residence on Pepperel Street for G. A. Cox, 30 Cherry Street. The following contracts have been let:—general, masonry, carpentry, steel, roofing, plastering, painting and interior fittings, G. J. Hilchey, 59 Allen Street; heating, Longard Bros., 213 Hollis Street; plumbing, W. S. Craig, 316 Upper Water Street; Electrical work, Sullifan & Hire, 74½ Gottingen Street.

In connection with the residences built on Louisburg Street for G. A. Cox, 30 Cherry Street, the heating contract has been let to Longard Bros., 213 Hollis Street, the contract for plumbing to W. S. Craig, 316 Upper Water Street, and for electrical work to Sullivan & Haight.

The following contracts hafe been let in connection with the three residences built at South and LeMarchant Streets by the Cranston Building Company, 132 Hollis Street:—heating, Longard Bros., 213 Hollis Street; plumbing, W. S. Craig, 316 Upper Water Street; electrical work, H. Tremaine, 65 Victoria Road.

In connection with the residence in course of erection at 10 Louisburg St. for G. A. Cox, 30 Cherry Street, the following contracts have been let:—general, masonry, carpentry, steel work, roofing, plastering, painting and interior fittings, A. Ferguson, 57 Shirley Street; heating, Longard Bros., 213 Hollis St.; plumbing, W. S. Craig, 316 Upper Water Street; electrical work, Sullivan & Haight.

Hamilton, Ont.

The general, masonry, carpentry and roolng contracts for the erection of a residence on Undermount Avenue for Taylor & Wilson, 100 Locke Street S., have been let to R. G. Wilson, 4 Rutherford Avenue. Brick construction, stone foundation, shingle roofing. Approximate cost, $3,000.

Montreal, Que.

The contract for painting at the residence erected for the Estate of Jonathan Brown, 1050 Dorchester Street W., has been let to the general contractor, A. K. Hutchison, New Birks Building.

F. R. Lanthier, 679 LaSalle Avenue, Maisonneuve, has let the contract for alterations to a residence at 373 Sherbrooke Street E., to A. Chartrand, 611 City Hall Avenue. Approximate cost, $5,000.

Ottawa, Ont.

C. Joyce, 1102 Somerset Street, has let the contract for plastering in connection with the alterations being made to apartments on Somerset Street to L. Lafontine, 503 Cumberland Street.

In connection with the residence built on Woodlawn Avenue for E. G. Brown, Hope Chambers, the contract for plastering and painting has been let to the general contractors, Cuthbertson & Clark, 143 Hawthorn Avenue, and for electrical work to C. C. Gould, 219 Florence Street.

The general contract for alterations and additions to apartments on Slater Street for the H. N. Bate Realty Company, Canal Street, has been awarded to Charles Hopewell, 7 Clemow Avenue. Approximate cost, $6,000.

In connection with the residence being erected on Bethany Street by J. Wilson, Wellington Street, the brickwork contract has been let to C. W. Dean, 21 Stirling Street, the carpentry contract to N. Trudeau, the contract for heating to J. Cameron, 488 Lewis Street, and for plumbing to F. Holt. Plastering and electrical work not let.

Quebec, Que.

The following contracts have been let in connection with the residence erected on the Avenue des Erables for E. Morissette, 208 Latourelle Street:—roofing, E. Falardeau, 308 Queen Street; plastering, A. Frenette, 2 Bourlamarque Street; painting, B. Vaillancourt, 92 Sauvageau Street; heating, plumbing and electrical work, F. Gingras, 34 St. Augustine Street.

The erection of a residence on St. Valier Street has been commenced by L. St. Michel, 199 Ste. Therse Street. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $7,000.

J. E. Boivin, 31 Sixth Avenue, Limoilou, has commenced the erection of a residence on St. Valier Street for N. Alain, 127 St. Luc Street. Brick and frame construction, stone foundation, metal and asbestos roofing. Estimated cost, $5,000.

In connection with the residence built on First Avenue for Damase Belanger, Boilenar Garneau, Domaine Lairet, the roofing contract has been let to O. Barbeau, 154 Franklin Street.

The contract for roofing, plumbing and gas installation at the residence in course of erection for W. Lapointe, 226 Marie de L'Incarnation Street, has been awarded to A. Breton, 235 Kirouac Street, and for plastering to F. Croteau, 21 Chateauguay Street. Painting by day labor.

In connection with the residence being erected on Third Avenue by J. Bornais, 76 Third Avenue, the roofing, plumbing and gas installation contract has been let to A. Breton, 148 Hermine Street. Painting and electrical work not let.

The contract for masonry and carpentry in connection with the residence in course of erection for David Jeon, 159 First Street, Limoilou, has been let to the general contractor, W. Bouchard, 105 Fifth Street, the contract for roofing to N. Barbeau, Bridge Street, and for plumbing and electrical work to J. Vaillancourt, 201 Fleurie Street.

In connection with the residence being built on Canardiere Street for L. Tremblay, 308 St. Joseph Street, the roofing contract has been awarded to L. Lajeunesse, 78 St. Agnes Street. Painting, plumbing and electrical work not let.

E. Belanger, 331 Fourth Avenue, Limoilou, is building a residence estimated to cost $5,000, and has let the contract for roofing, plumbing and electrical work to A. Lapointe, Fourth Street and Sixth Avenue, Limoilou.

N. Jobidon, 110 Fifth Street, Limoilou, has commenced the erection of a residence on Fifth Street for Robert Jobidon. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $8,000.

Ripley, Ont.

The general contract for the erection of a residence for B. Harris has been let to John Robertson. Frame and white brick construction, shingle roofing. Estimated cost, $3,000.

Sarnia, Ont.

A. McColman, 120 Mitton Street N., has commenced the erection of a residence on London Road for W. D. Steadwell, Alexandria Apartments. White brick construction, concrete foundation, shingle roofing. Approximate cost, $7,000.

South Bay, N.S.

The contract for galvanized iron work and roofing at the residence being erected for E. P. Baker has been let to J. E. Wilson Company, Sydney Street, St. John.

St. Lambert, Que.

Work has been started on the erection of a residence for George Bruce by the St. Lambert and District Building Company, Limited, 224 St. James Street, Montreal. The contract for electric wiring has been awarded to C. E. McGregor. Granite, frame and mill construction, shingle roofing. Approximate cost, $4,000.

Thorold, Ont.

Work has been started on the erection of a residence for Frank W. Moore. The contract for masonry has been let to John Porter. Other work by day labor. Approrimate cost, $3,500.

Westmount, Que.

Work has been commenced on the erection of a residence on Westmount Boulevard for Mrs. L. C. Fee. The contract for roofing has been let to Richardson, Simard & Company, 745 Clark St., Montreal, and for electrical work to Mcdonald & Willson Company, Limited, 99 Drummond Street, Montreal.

The contract for painting at the residence erected on Edgehill Avenue for C. W. Tinling, 456 MacKay Street, has been let to the general contractor, A. K. Hutchison, New Birks Building.

Power Plants, Electricity and Telephones

Beeton, Ont.

The Town Council contemplate the purchase of boiler and power house equipment. Clerk, Joseph Wright.

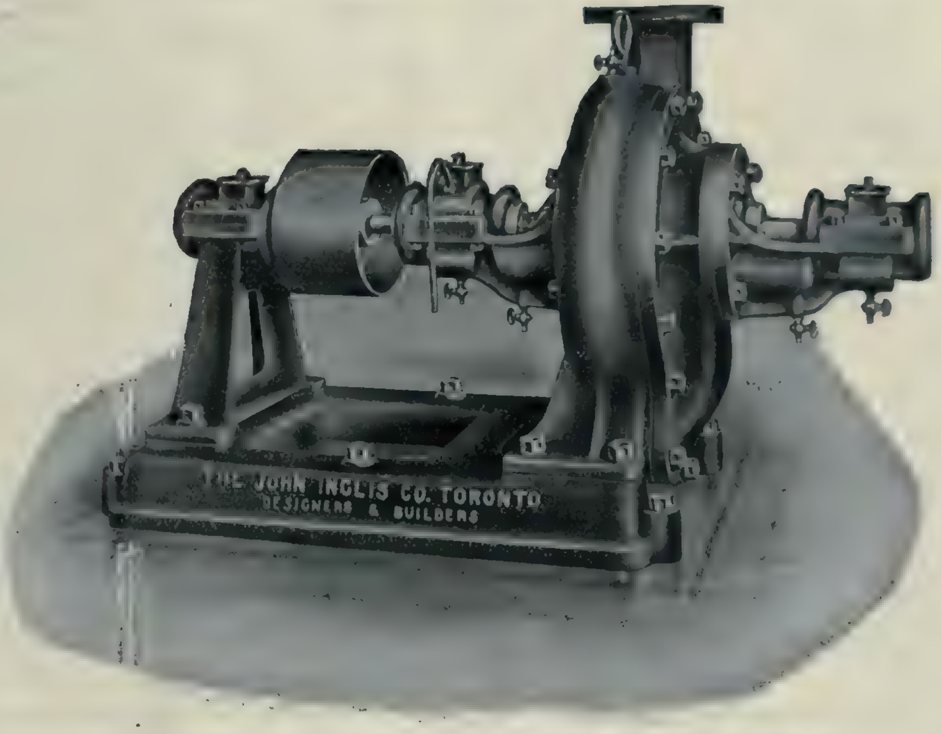
Blenheim, Ont.

W. R. Fellows is in the market for electrical supplies.

Toronto, Ont.

The Toronto Hydro Eelectric Commissioners propose to raise $1,375,000 for general extension work, meters, towers, etc.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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The John Inglis Company, Limited

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Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Miscellaneous

Fort William, Ont.

Tenders will be received until 4 p.m., August 31st, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa, for dredging in the Kaministiquia River. Plans and specifications at the Department. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Goderich, Ont.

The Doty Engine Company, Limited, Brock Street, are in the market for two turret lathes for shell making.

Ottawa, Ont.

O. A. Letts is in the market for pumps, drills and other equipment for the Russell Natural Gas & Oil Company, 83 Bank Street.

Pelham Township, Ont.

The Chippewa Gas Company are having plans prepared for gas mains to be laid from Cayuga to St. Catharines, and are seeking a charter from the Township Council for this work. Township Clerk, A. N. Armbrust, Ridgeville.

Port Dover, Ont.

Prices, catalogues and other information with regard to brick, fireproofing, hollow tile, steel, metal lath, library fittings, store fronts, canopies, fire escapes, and reinforcing bars are being received by G. Dillon.

St. Catharines, Ont.

Bulk or separate tenders will be received until 5 p.m., September 2nd, by the Chairman of the Finance Committee, for wrecking and removing a number of stores, residences and other buildings on the right-of-way to the St. Paul Street Bridge. An alternative tender will also be received for the salvage of the I. O. O. F. building and lot. Specifications with Engineer W. P. Near.

Toronto, Ont.

The Board of Control will receive tenders until August 31st for the supply and erection of an electric crane, hoist and single line clam shell bucket at the Main Sewage Disposal Works. Plans at office of the Works Department, City Hall.

CONTRACTS AWARDED

Peterborough, Ont.

The contract for the supply of castings until March, 1916, has been awarded by the City Council to G. W. Green Company, Limited, McDonell Street, at $2.25

Late News Items

Bothwell, Ont.

Work is about to start on the erection of a branch building for the Merchants Bank of Canada. The general contract has been let to Reid Bros., Bothwell. Approximate cost, $8,000.

Hensall, Ont.

The erection of a store at an estimated cost of $10,000 is contemplated by Alexander Murdock.

Lachine, Que.

The City Clerk, A. E. Sarra, Bournet, will receive tenders until September 2nd on the erection of the following buildings:—(1) Fire and police station in Ward 1, approximate cost $15,000, Architect, C. R. Tetley, 304 University Street, Montreal; (2) Fire station in Ward 3, approximate cost, $14,000, Architect, Dalbe Viau, 76 St. Gabriel Street, Montreal; (3) Fire station in Ward 4, approximate cost, $18,000, Architects, Benoit & Girard, 128 Bleury Street, Montreal.

Work has been started on the erection of a school and residence on Fifteenth Avenue for the Catholic School Commissioners of Lachine, St. Joseph Street. Carpentry by day labor. Plastering and painting contracts not yet awarded.

London, Ont.

In connection with the school in course of erection at Waterloo and Victoria Streets, the masonry, carpentry, steel, roofing, plastering and painting contracts have been let to the general contractors, J. Hayman & Sons, 432 Wellington St.

Muncey, Ont.

The general contract for the erection of farm and dairy buildings at the Mount Elgin Institute has been let by the Department of Indian Affairs, Ottawa, to A. E. Ponsford, 605 Talbot Street, St. Thomas. Frame and white brick construction, concrete and stone foundation, corrugated iron and shingle roofing. Approximate cost, $27,000.

Ottawa, Ont.

The contract for heating and plumbing at the school built on Daly Avenue for Les Chanoinesses, Cinq Places, 383 Daly Avenue, has been let to E. Claude, 67 Paren Avenue. Other work will be done by the general contractor.

Toronto, Ont.

Quotations are being received by MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, on the supply of one 1 or 1¼ yards Owens Clam Shell bucket, fitted with teeth and weight, and of one end dump McMyler drag line bucket, 1½ yards.

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Pumps

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Contract Record
and Engineering Review

Toronto Montreal Winnipeg
Vancouver London, Eng.

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Specifications and Contracts

IT has been pointed out several times recently that the present time affords a particularly favorable opportunity for work of introspection in every phase of constructional activity—in administration, in organization, and in the conditions by which the activities of the engineer, the architect, and the contractor are hedged in.

A phase of this subject is taken up in this issue by Mr. Wynne-Roberts, the consulting engineer, whose observations on specifications and terms of contract, settlement of disputes, and the basis of payment, are worthy of note.

Mr. Wynne-Roberts rightly suggests that with all that has been said and written there are still to be found many specifications whose terms might be said to be veiled in mysticism. Why these documents should continue in existence it is hard to understand, when one realizes the fruitful source of trouble, misunderstanding and expense that the imperfect specification has always been.

In our issue of April 29, 1914, we discussed "The Perfect Specification," and in leaving this phase of the subject it may not be amiss to quote the following:

> "That there is a lawsuit in every building contract (at the pleasure of the parties concerned) is an accepted axiom; hence, the contract is a document that is usually drawn up with considerable care, and legal minds are not infrequently requisitioned in its preparation. When it comes to the specification, however, laxity is more honored in the observance than in the breach. The clauses are strung together one below the other, with but little regard to what has gone before or what is to follow. Repetition and tautology become wearisome, while an infinity of unnecessary detail prolongs the length of the document beyond the bounds of necessity. The fact is only too often overlooked that the specification is as much a legal document as the contract; indeed, it forms, with the plans—and for the matter of that with the correspondence that ensues—a part of the contract, and the two must stand or fall together. Specification writing must be regarded as an important branch of the work of the engineer and the architect, and it is difficult to understand how the lamely-worded, halting, ungrammatical documents that one only too often sees can come from the pens of men whose calling presupposes the receipt of a fairly advanced education."

It has been asserted that with a concise, clear and consistent specification and a full set of quantities the tenders of a score of competent men need not vary to a greater extent than five or six per cent., whereas fifty or sixty per cent. is now not uncommon.

The subject of disputes between architects or engineers and contractors is a vexed one, and the suggestion of a system of arbitration has much to commend it. Given an arbiter of recognized standing in his profession, and of unimpeachable integrity, the items in dispute can be more freely discussed and more easily decided upon in arbitration than in litigation. No substantial objections have ever been made to this form of adjudication, and it is difficult to understand why it has not been adopted more largely. One of the outstanding advantages it offers is the mediation of one specially qualified to deliver judgment on constructional matters. It is more speedily set in motion, and it generally affords escape from legal hair-splitting of words and phrases in the contract, and also from some of the circumlocutory eloquence heard in arguments. The desire of the contending parties is to get at the kernel of the dispute at once and have it decided upon.

One of the essentials of close tendering enumerated above is "a full set of quantities." We are inclined to the belief that the day of the quantity surveyor is at hand, and that he will come into his own in Canada with the active resumption of constructional enterprises on a large scale. Quantity surveying is found most satisfactory where it is in use, and the system is coming more and more into favor in the United States. For a dozen contractors to go through the laborious process of figuring up the quantities on, say, a warehouse and office building running into two or three hundred thousand dollars, where the engineer or architect could prepare a bill of quantities which the contractors could price, thus ensuring closeness and accuracy in figuring, and removing the possibility of mistakes—which the owner always has to pay for in the long run—is an economic absurdity.

The Optimism of Advertising

TWO things make advertising almost a synonym for "optimism." One is that the advertiser who would be successful must be an optimist. The other is that when an advertiser loses his optimism he generally cancels his advertising.

"Business is rotten!" exclaims the manufacturer, and forthwith orders all his advertising to be stopped, little realizing that his own action is one of the causes that makes business "rotten."

Cancelling advertising is so easy that it is nearly always the first step towards retrenchment. The matter is seldom decided on its merits. It is impulse. Advertising must be "an expense," the advertiser reasons. Therefore to cut it off effects a saving.

The stoppage of advertising during times of stress and change has two bad effects upon the business involved. It turns off immediately a method of securing new business and holding old business. In addition to that, it advertises the pessimistic views of the advertiser, and therefore spreads his own lack of faith in himself, his goods, his country, and the future to other business men who are, perhaps, also on the verge of doing the same thing.

The point is that the war will either end everything in the world or it will not. If it does not, business, among other things, must go on. In our own country, it must go on now. It cannot wait until the war is over.

In this country there are a hundred million of us who must live and who must buy all the things that make life possible, and somebody is going to supply these things.

There are very few articles that we cannot make or produce. We have now an opportunity to find out what we can do. All of these new resources will develop business and that activity which ultimately results in good times.

Every manufacturer who has been in the habit of advertising and who can get materials from which to manufacture his goods, ought to push on with his method of selling goods, advertising included, just as in normal times. If he is a real advertiser he will realize that at such a time his competitors will probably relax their efforts, and he therefore should make a corresponding advance in his.

"After the War"

MANY British business men, to judge by both their private and public utterances, seem to have adopted a motto which is as dangerous and destructive to progress as the comfortable, easy-going Spanish "manana," says Mr. H. E. Morgan in The Daily Telegraph (London). To all suggestions of methods by which British trade may be strengthened, developed, and extended, their invariable answer is "After the War." "Our great and only aim now," they say, and quite rightly, "is to beat the enemy." This can only be done by action. But great as is the need for men of fighting age, great as is the need for munitions of war, these are not the only weapons with which we are fighting. Our strength as a world-force depends not only upon these, but upon the "silver bullets" that go to pay for them upon the national credit, which can supply the "silver bullets" in abundance, and upon the trade on which national credit ultimately rests.

There are many business men who, for one reason or another, can neither fight nor make munitions. There is nothing unpatriotic—quite the reverse—in the conduct of such men if they devote their attention now to making such plans and taking such steps as will enable British trade to make a great leap forward when peace is declared. We shall have a big bill to foot for many years to come, and the only way in which we can pay it satisfactorily is by widening our markets; but it will be too late to seek them "after the war." Neutrals are already making preparations to capture them, and unless we are up and doing now we shall fall behind in the race. Belgium is one of the many fields for British commerce, and we must be preparing to win Belgian trade.

There seems to be an idea that as the bulk of Belgium is now in German occupation, even preparations for future trade with it are taboo. But once the incubus is lifted Belgium will return to its normal condition of bustle and activity. Belgium will be in the market for countless articles, and it is safe to say that few, if any, of these will come from Germany. To whom will the orders go—to the nation which is making its preparations now or to that one which is putting off till "after the war"?

Waste Not, Want Not

ON all sides we are enjoined to economize during the war, says a writer in a breezy paragraph in a London contemporary. Should one have a fondness for the juicy rump steak, we are recommended to restrain the inclination and be satisfied with a few pennyworth of pieces, or, better still, do without meat altogether. The daily papers furnish us with hints how to supply a dinner for father, mother, and half-a-dozen children at somewhere about three-halfpence per head. Those journals devoted to the ladies gravely tell us "a leading chemist" has discovered that straw may be made a most palatable and nutritious article of diet if treated with certain acids. It is furthermore suggested we be content with one suit of clothes. Everything, in fact, points to curtailing our expenses and economizing. Buy little or no meat. What, then, is to become of the butchers? Fewer clothes, and the tailors feel the pinch. No amusements, and theatrical artists and workpeople done out of employment. Less tea, less sugar, less bacon, and the grocers suffer from diminished trade.

If that "leading chemist" be right and a sustaining food may be made from hay or straw, then we suppose these will very soon advance in price. But on all sides the cry is to economize, and we are wrongly or rightly accused of being the most wasteful people in Europe.

Painting Steel Structures

AT a conference of engineers of the Phillipine Islands, held recently at Baguio, the painting of steel structures came in for considerable discussion. The prevention of steel structures was conceded to be a matter of vital importance, and it was admitted that past experiences with paint had not been as successful as could have been desired. Several recommendations were agreed upon, among them the following: The use of pitted steel should be prohibited by specifications; standard specifications should provide that all plates and shapes be cleaned by sand blasting before assembling in the shops; for shop painting red lead should be used, as at present; all bridges painted with graphite primer should be thoroughly cleaned and repainted in accordance with standard specifications; no field painting should be done except after the most careful and thorough cleaning of the steel surface, and then only after four hours of sunshine on a bright, warm day, so as to insure a dry surface on which to paint; the use of tar paint should be discontinued, except as required for special purposes, in which case special specifications should be prepared by the division of design or in duly authorized tests; boiled oil should be used for bridge painting instead of raw oil, and one or more portable sand blast outfits for use in the field should be supplied. The Kansas City method of coating steel with cement grout put on with a cement gun and held by wire mesh reinforcement came in for a slight discussion, and it was suggested that the method might prove advantageous for steel bridges over salt water.

Irrigation in Southern Alberta

EXTENSIVE irrigation schemes affecting about 500,000 acres of new land in Southern Alberta are being developed by the irrigation branch of the Department of the Interior, under the direction of Mr. H. Peters, Irrigation Commissioner. The nucleus of the system now being planned is being opened up this season, covering 30,000 acres in the Taber district east of Lethbridge, which is under development by the Canadian Pacific Railway. The government engineers are now conducting a survey for the extension of this system for a considerable distance east of Taber. The second branch of the new system will include the area lying east of Stirling to Foremost, along the Lethbridge-Weyburn branch of the Canadian Pacific Railway. A third branch will cover the area east of Coutts along the international boundary. It is proposed to furnish the water for these branches of the system through three main arteries tapping the St. Mary's, Belly, Waterton and Milk rivers. As a considerable amount of the Milk River water will be diverted by an American irrigation project, the government engineers are planning to bring water from the Waterton and Belly rivers to make up for that to be thus diverted. An artery from the Milk River, a little to the west of Milk River town, will furnish the supply for the third branch. Survey parties are now in the field making an accurate survey of the course of the river.

Another scheme, the surveys for which have been already made by the government engineers, is known as the Old Man River diversion project, by which it is proposed to irrigate 100,000 acres of the lands to the north of Lethbridge. These various works will not be built and operated by the government, which simply proposes to undertake the necessary surveys so that they may be in readiness when construction is undertaken by local organizations. Under recent legislation adopted by the Alberta Government the farmers are authorized to organize irrigation districts, bonding each district for the cost of the system, the farmers paying for the use of the water. This law will apply to all irrigation systems undertaken in the future. While the Old Man River project is likely to be executed in the near future, the construction of the other systems may be deferred for some time until the country, to be served by them, is more thickly settled.

What is a "Street"?

EVERY branch of labor, sport or other human interest acquires a vocabulary of its own, from handling a pick and shovel or "tag" to electrical machinery design or war. Many times words acquire meanings in these vocabularies different from those of their every-day use. It is easy to see why these special meanings develop, but every effort should be made to limit the number of them because of the doubt as to the meaning which may arise when the terms are used in a popular or semi-popular description. And the more nearly the subject is concerned with the interests of the public, the more should the ambiguity of these special meanings be avoided.

The Municipal Journal, in drawing attention to this matter, points to the publication by New York City of its corrected regulations for street traffic as prepared by the police department, which starts with "Definitions: (a) The term street shall apply to that part of a public highway intended for vehicles." Now there is only one reason for this that we can conceive of—that "street" is a shorter word than roadway, and one or the other must be used a dozen times or more in the regulations. But there are twenty reasons why "street" should not be so limited in its meaning as to exclude the sidewalks.

Webster definies a street as a "thoroughfare bordered by dwellings or business houses." The courts have ruled that the word street is understood to include the sidewalks. The police department itself, outside of the traffic force, is concerned with the street as a whole, including the sidewalks. It is very unfortunate that the citizens, who have only in recent years been educated to appreciate that "pavement" is not a term specifically designating a sidewalk, should now be confused by instructions given by a department of the municipal government to make a wrong use of the word street.

Misuse of other common words in these regulations is so absurd as to be amusing. Unfortunately it is liable to mislead foreigners who are just learning the language. For instance, the definitions state that a horse is a vehicle; that a goat, if drawing a cart, is a horse; that a baby carriage is not a vehicle but that a wheelbarrow is, and that the man who is pushing it is a "driver," and that no driver shall be less than sixteen years old.

There are abundant words in common use to specifically designate every idea which is embodied in these regulations, without this misuse of the language, which is not only slovenly and uncalled for, but is liable to be misleading (one does not generally think it necessary to turn to a glossary of terms when reading about "horses," "vehicles" and "streets") and offers possible opportunity for legal defence against prosecution for an infraction of the regulations.

St. Michael's R. C. Church, Montreal — "One of the Most Interesting Reinforced Structures on the Continent"

THE St. Michael's Church, which is now being erected in Montreal, at the corner of St. Urbain and St. Viateur Street West, is one of the most original, and from an engineering point of view one of the most interesting reinforced concrete structures on the continent.

The church covers an area of about 100 x 200 ft., and the basement proper, as well as the main auditorium, is free of columns. The whole structure is built of reinforced concrete. It contains many interesting features, such as flat arches, full arches, self-supporting spiral stairs, galleries carried on cantilevers and on arches, a half dome 52 ft. in diameter, a full dome 74 ft. in diameter, with 24 windows, and a tower 120 ft. high.

The building of the church was started in June, 1914, but in September, 1914, the work was stopped owing to the unsettled conditions brought about by the war, and operations were resumed only in July, 1915.

The church is designed in the Byzantine style. After its completion only the domes and roofs will have the concrete exposed; the remainder of the structure will be covered with cut stone, Greendale brick and terra cotta. The interior will be left unfinished at present, but at a future time the interior decoration will be carried out on similar lines (Byzantine style) as the outside.

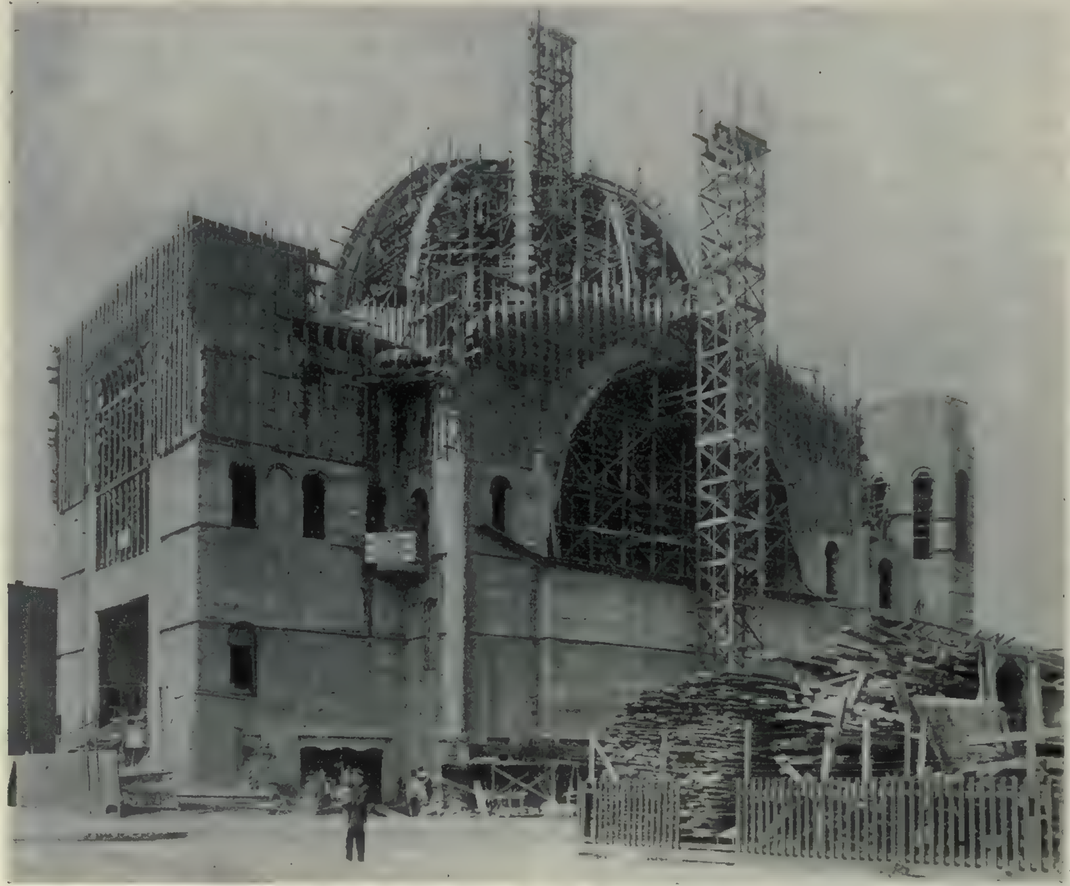
The basement ceiling is about 7 ft. above ground, and is carried by flat arches, having a clear span of 54 feet, spaced at 18 feet c. to c. The floor between the arches is flat, with no projecting beams.

The winding stairs are in four heavy square towers, which constitute the main piers for the four full arches of 52 feet diameter, which carry the dome.

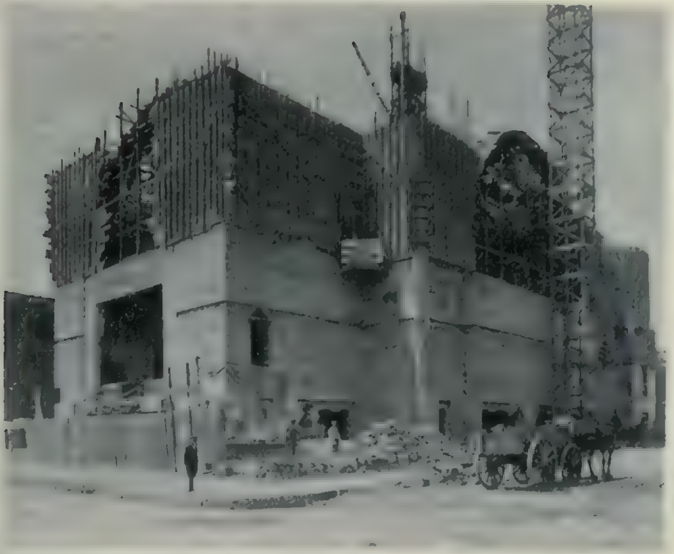
The accompanying progress photographs give a general idea of how the work was carried out and show the main features of the structure.

The plans were prepared by Mr. A. Beaugrand-Champagne, architect, of Montreal, and the work is being carried out under his personal supervision.

The structural design in connection with the rein-



St. Michael's Church, Montreal—front and side elevations. Note the form work in dome. Architects, Beaugrand-Champagne & Chenevert, Montreal; contractors, Atlas Construction Company, Montreal.



St. Michael's Church, Montreal—front and side elevations, showing form work for arches.

St. Michael's Church, Montreal—rear elevation, showing half dome completed, and tower under construction.

forced concrete was made under the supervision of Mr. C. M. Morssen, C.E., Consulting Engineer to The Atlas Construction Company, Limited.

The engineering problems which this work presented were of rather unusual importance and were solved in consultation with Professor E. Brown, of McGill University, and Mr. W. D. Lawrence, consulting engineer, of Montreal. Mr. S. Smith, C. E., at present with Messrs. Thompson & Gildersleeve, engineers, of Syracuse, N. Y., prepared the calculations and working drawings for the foundations and for the flat arches (54 ft. span) of the basement floor.

The Atlas Construction Company, Limited, who have carried out important reinforced concrete contracts, are the general contractors, and Mr. J. J. Shea is their superintendent.

Old Steel of Razed Building Examined for Rust

Only Slight Deterioration Found in Painted Members of Building, Erected in 1894

FROM a recent examination of the rusting of the twenty-year-old steel members of the fifteen-storey Champlain Building in Chicago, which has been razed to make way for a new structure, Holabird & Roche, the architects who prepared the original plans, conclude that the exclusion of air and moisture is essential for the preservation of the steel and also of the paint. The appearance of the rust, says The Engineering Record, suggests that it may have been formed soon after the building was constructed in 1894 and that it has not been progressive. Even if the worst case of rusting had been progressive and should continue at the same rate, it would be more than a century before failure of the members would result, according to the architects. They conclude that the present practice of encasing all structural steel in concrete or plastering it with Portland cement mortar, of separating the pipe shafts from the steel and of using greater care in covering terra cotta anchors, safeguards the framework of the structure for a much longer period than the probable economic life of such buildings.

The lot occupied by the Champlain Building is approximately 66 x 105 ft. The building, which cost $500,000, was fifteen storeys above grade and one shallow basement storey below grade. It consisted of a structural steel framework with joists spaced 5 feet apart, flat-tile arches of porous terra cotta, porous terra cotta fireproofing, shallow spread footings on a blue clay foundation, locally called floating foundations, and brick and terra cotta curtain walls.

The steel was painted with a proprietary brand of iron-oxide paint, in accordance with the following specifications: "The contractor will be required to paint all ironwork and steelwork one coat of the best quality of mineral paint before putting up. After it is set, carefully go over all work, clean and remove all rust and dust and paint another coat of the same kind of paint."

The condition of the paint varies from complete disappearance to "good as new." So far as protection to the general structure is concerned the paint has deteriorated beyond all usefulness. In places there is no trace of it. Over most of the steel the paint still shows, but is broken up by rusted areas, in a few places it still has its color and lustre over considerable areas. Even where small blisters showed in the paint, the steel underneath was bright and free from rust.

There was no pitting of the steel observed, the rust occurring in flakes or layers. Some pieces having areas from 50 to 100 square inches were removed from the webs of I-beams. By weighing some specimens of rust scales taken from the inner sides of the webs of beam box girders not filled with fireproofing and reducing to the equivalent metallic rust, the loss due to corrosion is computed to be .007 to .009 in.

This is very much greater than the average loss, as these specimens represented the worst condition except one case. One column in the first storey showed rust amounting to perhaps four or five times the amount stated above. This bad rusting was along a pipe shaft where the steel was doubtless subjected to moisture or circulation of air.

The footings were built of steel I-beams unpainted, embedded in Portland cement concrete. When removed they showed no corrosion. The pipes in the building were generally in fair condition. There is no record of any of them having been replaced since the building was constructed. However, one pipe, presumably a soil pipe, was so decayed that it could be broken as if made of earthenware.

It was specified that the terra cotta be attached to the steel frame "with substantial wrought-iron or copper anchors, and thoroughly embedded in cement mortar." Wrought iron or steel was used. The anchors were generally in good condition, but some pieces were rusted so much that they were broken in wrecking. It is probable that these pieces were not well bedded in cement mortar at the points where the rusting occurred.

Terms of Contract

R O Wynne-Roberts, Consulting Engineer, Toronto

WHEN times are prosperous and things are moving with a vim, engineers, architects and contractors have not the leisure to revise their specifications and terms of contract, but when periods of comparative inactivity come they may be more inclined to think the matter over.

Much has been written on the subject of specifications and terms of contract, and doubtless in many instances advantage has been taken of the information thus gleaned to remove some ambiguities and anomalies. But probably there are plenty of specifications which contain clauses which are often not only impossible of execution but cause considerable irritation on both sides. Qualities of timber and other material, methods of construction and working details are often so specified that contractors are unable to comply, and claims are made. It seems a reasonable proposition that specifications should be prepared with a view to the simplification of the language, and conciseness. It is, of course, well known that all men are not as scrupulous as they might be, and consequently provisions are inserted to meet such contingencies. Hence specifications have assumed considerable proportions and have given occasion to frequent disputes Many specifications stipulate that in the case of disputes arising between the contractor and the architect or engineer the decision of such architect or engineer is to be final. The work in dispute may not be mentioned or shown in the drawings and specifications, but the conditions state that the work shall be complete in every respect, and what has been omitted to be shown or specified is notwithstanding to be included in the contract. Architects and engineers are just as human as contractors; they all desire to protect themselves, and if by any chance any of them get into a hole they want to get out as easily as possible. If, however, the hole was left by the architect or engineer, it is hardly reasonable to expect the contractor to remedy the same solely at his own expense. On the other hand, when contractors have undertaken contracts at low figures in the hope of making the profits out of extras, and such extras are not allowed, disappointment is experienced and the relation between the two parties is perhaps not so pleasant. Claims are made only to be decided upon by the party who drew up the contract. In most cases the differences between the architect or engineer and the contractor are settled amicably, and as satisfactorily as possible (for rarely is either side entirely satisfied), but in the other cases the differences are not adjusted as satisfactorily, and litigation sometimes follows. It seems reasonable that the architect and engineer, as well as the contractor, should have some more equitable method of settling disputes than by resorting to prolonged litigation. Arbitrations are less cumbersome and expensive, and can be set in motion more quickly. The questions in dispute are usually based on facts, and not on the lagal interpretation of phrases or clauses, and consequently the arbiter should be one who has had practical experience in construction instead of legal training. In a large number of instances the disputes are not difficult to arrange when the arbiter is familiar with the work and conditions.

In the absence of some method of adjusting disputes the contractor must perforce increase his prices to cover himself. In other words, the client has often to pay more than he should, for he has to pay for contingencies which may not arise. If the contract payments are based upon a price bill of quantities the client and the contractor know at the commencement what the contract entails.

If the plans and specifications are studied carefully and the bill of quantities is priced according to the nature of the work, and any deductions or additions are allowed for, according to the same schedule of prices, both parties are reasonably protected. This means, however, that the quantities have to be ascertained by some recognized method and by someone familiar with the work. Hitherto quantity surveying has not been practised extensively in North America, but it is now being strongly advocated in the United States, and when the parties interested in contracts come to see the value of quantities prepared according to established rules this method of letting out contracts will probably be adopted more largely.

In one of the new office and salesroom buildings rapidly approaching completion in New York City an ingenious arrangement of duplicate stairs, scissor fashion, has been incorporated so that two staircases are in one shaft with two separate entrances to each loft, thereby saving floor space.

Unless braced, parapet walls are liable to be blown over when subjected to the pressure of high winds. The parapet wall of a Philadelphia mill, which extended seven feet above the ridge of the roof, was blown over recently, causing a property loss of several hundred dollars.

Cost, Appearance and Wearing Qualities of Various Methods of Surface Finish for Concrete

THE following data on the cost, appearance and wearing qualities of various methods of surface finish for concrete were compiled by Sub-Committee D of the Committee on Masonry of the American Railway Engineering Association and are presented herewith in the form abstracted by Engineering and Contracting. Requests for information on this subject were sent to the various railway companies, and the data are based on 52 replies received. A review of the answers received gives the following methods as most generally used:

(1) Spading, to Work Coarse Aggregate Away from Form and Bring Mortar Against it

This method is the one generally used, and where decorative treatment is not necessary furnishes the best finish at the least expense. The surface is generally smooth and nearly impervious to moisture, and its wearing qualities are equal, if not superior, to those of any other method.

(2) Coating with a Wash of Cement

A wash usually of 1 part cement and 1 part sand is applied with a brush after the forms are removed. This fills up the pores and covers the small inequalities and wood grain marks and gives a smooth surface of even finish and uniform color. This film of mortar, however, is liable to become checked and hair-cracked and often scales; for this reason it is not generally used.

(3) Rubbing

There are several methods of treatment, as follows:

(a) The forms are removed as early as practicable, prominent joint marks chipped off, and the surface thoroughly wet and rubbed with a cement mortar or carborundum brick.

(b) After the forms are removed, the surface is rubbed with wooden floats, keeping the surface well flushed with water during the rubbing and thoroughly washing after the rubbing is completed. The earlier the rubbing is done the better the results. The rubbing removes most of the inequalities; it fills the pores and small cavities, and gives the surface a uniform finish and appearance, and does not flake or scale.

(4) Removing Outside Mortar to Expose Coarse Aggregate

There are several methods of accomplishing the result, all dependent on the use of a surface finish or coating at least 1 in. thick, composed of prepared aggregate, which coating is deposited as the placing of the concrete proceeds:

(a) Wash the surface immediately after the forms are removed, exposing the aggregate, which is usually done by scrubbing with stiff brushes of either bristle or wire, and water, protected from the sun for about three days.

(b) Treat the surface with an acid, usually commercial hydrochloric and nitric. The acid attacks the cement and exposes the aggregate. The amount of dilution of the acid is usually obtained by experiment and varies with the age of the concrete.

(c) Removing the outer skin by means of a sand blast; This method has not generally proven succesful, as it is very difficult to obtain a uniform surface.

(5) Tooling Surface of Concrete with Crandall, Bush-Hammer, etc., After Removal of Forms

This method, applied to the extent of cutting slightly into the aggregate, produces a very attractive surface, and it is the experience of many engineers that for work in which the best possible appearance is desired, bush-hammering provides the desired results at a minimum cost. The best results are produced with spaded surfaces or those composed of special aggregate.

(6) Scoring

Scoring the surface by means of a system of horizontal and vertical V-shaped battens placed on the forms to break up the flat appearance, to make a line designating the completion of the day's work, to indicate expansion joints or to produce the effect of courses.

(7) Metal Forms

Forms of metal or wooden forms lined with metal give a smoother surface than bare wood. The spading is done in the same manner as with wooden forms to push the aggregate back from the face. In doing this an excess or thin skin of rich mortar is brought to the surface of the concrete, and is liable later to develop checks and hair-cracks and become unsightly.

Abstracts of Replies

The accompanying data are abstracts of some of the replies received, the replies being based on the following requests:

(1) What methods of finishing surfaces of concrete work have you used? Give specifications of each method used.

(2) State object desired in finishing and results obtained as to appearance and wearing qualities.

(3) State the cost of the work per square foot (labor and material) for each method.

(4) Please state your opinion as to the best manner of finishing a concrete structure. Do you believe the concrete surface should be left untreated, or should it be tooled, scraped, or treated with an acid

(5) Is it your experience that where the natural surface of concrete is treated it is more susceptible to discolorations from smoke and the weather?

(6) Remarks.

In these abstracts, reference numbers refer to the above six items.

A. W. Buel, Consulting Engineer, New York City

(1) (a) Rice water wash: 1 bbl. lime, slacked, making 3 bbls. slacked + 25 lbs. salt + 10 lbs. rice, boiled and strained. Add chrome and ochre to give desired tint and put on like whitewash. It will not rub off.

(b) Carborundum wheels: Carborundum wheels on a mandrel driven by electric motor will duplicate six-cut work or four-cut work. If worked on concrete three to six days old, can be done very rapidly.

(2) (a) Gives uniform surface of pleasing appearance.

(b) Gives a cut-stone appearance, not imitation stone, but artificial stone, removes surface defects, gives square arrises and brings out color of ingredients.

(3) (a) About the same cost as ordinary whitewash, but more uniform and attractive in appearance and will not rub off.

(b) About one-third or one-fourth the cost of tool dressing.

(4) Bridge masonry in country generally left untreated. For ordinary work in towns I prefer rice water wash. For buildings in towns of first class I would dress trim, corners and arrises with carborundum wheels.

C. H. Cartlidge, Bridge Engineer, C., B. & Q. R. R.

(1 and 2) In the beginning of our concrete work in 1889, it was our practice to face the concrete against the form boards by working the grout against the forms. A great deal of rough lumber was used in the early work, and as we enlarged the use of concrete we tried to improve its appearance by depositing the mortar against the form and filling in back of it with concrete. Another method was to leave the concrete rough and plaster it. In the 25 years that have elapsed since these experiments it has become evident that the original method is by far the best of the three, and that the more nearly homogeneous the concrete can be maintained the better will be the wearing qualities of the surface and even of the concrete itself. In later work we have adopted the same principle, but have used surfaced forms, even lining them with sheet steel to obtain smoother surface.

(3) The cost of the spade finish is practically nothing; it takes a little more labor to confine the greater part of the puddling to the concrete on the outside than it does to have the same men do all the puddling in the mass. The cost of bush-hammering will run from ¾c. to 2c. per square foot, depending on the age of the concrete, amount of work, accessibility of work, etc.

(4) The writer believes that this working the grout against smooth forms gives the best results for the cost, but at the same time there is formed by this process a thin skin of rich mortar or grout against the form and on the outer surface of the work, and this checks up with minute cracks and in the end will probably be more or less unsightly. It is true that these cracks are very small and there is not the tendency for the film of rich mortar to scale off, which is exhibited in every case in the thicker mortar facing used in earlier work. In 1900 an experiment was made with bush-hammering some concrete which had been faced in the most careful manner by spading against the form; a portion only of the work done at that time was bush-hammered so that there is an excellent chance to judge of the relative merits of the two finishes. As the result of this it is the writer's opinion that for work in which the best possible appearance is desired bush-hammering provides the desired result at a minimum cost. In a good deal the work finished by spading against the forms improvement on the surface obtained was by rubbing with carborundum brick; this gives a good surface and pleasing appearance temporarily, but it has been found that it is difficult to obtain a uniform texture by this means and that exposure, while it does not affect the material itself, causes the washing away of the fine particles of concrete ground off by the carborundum, and the work is really not very much better than ordinary spade finish work, unless the grinding is carried to an extreme. Considerable experience with plastering leads to the belief that, while it is not impossible to make a good finish thereby, it is very expensive and extremely difficult, with the chances all against a good job.

(5) It is evident that the rougher the completed surface, the darker it will naturally become by exposure, smoke and weather, as every indentation must receive and retain some coloring matter from the smoke. On the other hand, such a thing as an absolute plane surface is a practical impossibility. There will be slight waves, small ridges, etc., left by the seams in their forms and their slight distortion, and where a spade finish alone is used the contrast between the dark markings in the seams and the lighter places in the smooth surface is disagreeable in effect, while by bush-hammering an effect of uniformity of texture is obtained, which is much more pleasing to the eye. The bush-hammering has also the effect of cutting away the rectangular markings of the face, which are particularly objectionable from the standpoint of appearance.

W. C. Cushing, Chief Engineer, Maintenance of Way, Pennsylvania Lines West of Pittsburgh

(1) (a) Acid treatment at Columbus, O., 1909-10. In 1909, surface was rubbed with carborundum bricks until aggregate was exposed, and washed thoroughly with solution of muriatic acid to remove all lime. In 1910 surface was rubbed with emery wheels operated by electric power, and then treated with the acid solution.

(b) Float finish, at Pittsburgh, Pa., in 1912, and at Cincinnati, O., in 1913 and 1914. Forms removed as soon as possible and ridges chipped off. Surface then sprinkled with water and rubbed well with pine wood floats. Surface and washed down with water after rubbing was completed.

(c) Rubbed finish, at Indianapolis, in 1914. As soon as forms were removed the surface was first rubbed with carborundum brick to remove spots; then rubbed with mortar brick made of 1 part cement and 2½ parts sand.

(2) (a) At Columbus, acid treatment was used in work on concrete encasement of bridge girders and columns in city streets where ornamentation was desired. The acid treatment finish was used to avoid the occurrence of hair cracks, checking and efflorescence in surface of the concrete, and was successful.

(b) At Pittsburgh and Columbus, a smooth and nice-appearing face was desired at the minimum cost, and the same was obtained. The surfaces of the copings and parts most exposed to action of weather have hair-cracked and checked slightly, but greater part of work is wearing well.

(c) At Indianapolis, the masonry abuts streets and a neat finish was desired.

(3) (a) At Columbus, cost in 1909, with rubbing done by manual labor 12c. per square foot; cost in 1909, with rubbing done by electric power, 6c. per square foot.

(b) At Pittsburgh, average cost of float finish was about 4c. per square foot.

(c) At Cincinnati, average cost of float finish was 3c. per square foot.

(d) At Indianapolis, the cost to contractor was about:

Plain walls, 4½c. per square foot.
Paneled portals, 6½c. per square foot.
Octagonal columns, 7c. per square foot.

George W. Kittredge, Chief Engineer, N. Y. C. & H. R. R. R.

(1) (a) On the face and back of all concrete structures above foundations, fine stone forks or spades shall be used to work the coarser part of materials back into the mass, to allow the mortar or finer parts to occupy the space adjacent to the forms in order to secure a smooth, even surface. Immediately after the forms are removed, surfaces that are to be exposed in the finished structure shall have all projections and irregularities carefully removed and all cavities neatly filled with mortar. Unless otherwise required, the faces shall then be rubbed to a smooth, uniform finish, with a flat stone or other acceptable device, using as little mortar as possible. Enough 1:2 cement and sand mortar shall be used to fill the pores, but no "plastering" will be permitted. For a period of ten days after the surfaces are thus finished, they shall be protected by moist canvas or other suitable material. When so indicated on the drawings, surfaces shall be tooled or treated by sand blast.

The following specification is used in the Electric Zone:

The outer exposed surfaces of concrete work shall be made dense and as impervious to water as possible, by carefully working the coarser materials back from the face of the form by means of a shovel, bar or other tool, so as to bring a layer of mortar to the face, or by depositing next to the form and simultaneously with the concrete a 1-in. layer of facing mortar. The rear faces of all structures shall have the finer portions of the mixture worked to the face by means of spading with shovel, bar or other tool, so as to secure a dense, impervious, smooth surface that will exclude water. Any holes or voids remaining after the removal of the form shall be struck smooth with pointing mortar. The molds shall be removed from the face of the concrete, and the exposed surface is then to be rubbed to a smooth or sandpaper finish with carborundum brick or other suitable device. In no case shall the imprint of any joint of the mold or of the grain of the wood be visible on any exposed surface of the concrete. If any defective work is found, such work must be cut out and replaced by rich concrete or mortar in such proportions and in such manner as directed by the Engineer. It is important to obtain uniformity of surface and color in the exposed portions of the work, and all work shall be finished free from discolorations, streaks, cracks, checks and other imperfections injuring the appearance or the life of the work. To obtain this result the same kind and quality of material shall be used throughout the structure. The exposed surfaces of all bridge seats and copings shall be floated and troweled smooth and hard and true to line and grade.

The general field practice for finishing surfaces in the Electric Zone is to remove the forms while the concrete is still green, and float the surfaces with a wooden float and clean water, until the board marks are removed and a uniform surface is obtained. When the concrete is harder, as in reinforced structures, where it is advisable to leave the forms in place for a longer time, a cement brick, made of 1 part cement and 2 parts sand, is used, with clean water, applied with a brush. When the concrete has become very hard, a carborundum brick is used instead of a cement brick. Additional mortar or cement is not applied, except where there are open or porous places, the idea being to rub down the body of the concrete rather than to add thereto in order to avoid "plastering," which in time is liable to peel off. Structures finished by above methods may be viewed at Yonkers, White Plains, Ossining and at various other points.

Other methods for finishing concrete surfaces have been used particularly in connection with building specifications for first-class passenger stations and minor buildings provide as follows.

Smooth Concrete Facing.—Where concrete is shown marked or specified as "Faced,"' such surfaces shall be painted with one thin coat of pure cement and water of the consistency of cream, applied with a brush.

Rough Concrete Facing.—Where concrete is specified on the plan as "Rough Faced," such surfaces shall have a full depth of at least 1½ in. of concrete deposited simultaneously with the backing, and made with selected gravel pebbles, crushed marble or crushed granite, as selected by the engineer, as will pass over a NNo. 3 sieve, meshes ⅜ x ⅜ in., and through a No. 1 sieve, meshes 1 x 1 in., set at an angle of 45 deg. The forms shall be removed from this surface before the concrete is set hard, and the face shall be brushed with wire brushes until the stones have clean faces and project ¼ in. from the cement binder.

A good example of the rough facing can be seen on the Scarsdale passenger station.

The following clause is given in specification for our standard brick freight house and the former Schnectady improvement:

After the molds are removed, any open or porous places shall be neatly stopped with a porous mortar, and if so directed by the engineer, the exposed face of the work shall be washed with neat Portland cement to give a uniform, smooth finish to the exposed surfaces.

The specifications for the Buffalo grade crossing improvements, dated March, 1907, contain the following clause for granolithic face:

The network of walls, abutments, piers and copings shall have a granolithic surface 1 part Portland cement, 2 parts sand and 2 parts granolithic grit made into a stiff mortar. Granolithic concrete shall be granits, trap rock or limestone, crushed to pass a No. 1 sieve and screened of dust.

For vertical surfaces the mixture shall be deposited against the face forms to a least thickness of 2 in. by skilled workmen as the placing of the concrete proceeds, and thus form a part of the body of the work. Care must be taken to avoid the occurrence of air spaces or voids on the surface. The face of forms shall be removed as soon as the concrete shall be sufficiently hardened, and any voids that may appear shall be filled with the mixture. The surface shall then be immediately washed with water until the concrete is exposed and rinsed clean and protected from the sun and kept moist for three days.

For bridge seat courses, pedestals or column bases and copings and other horizontal surfaces, the granolythic mixture shall be deposited on the concrete to a least thickness of 1½ in. immediately after the concrete has been tamped and before it has set, and shall be troweled to an even surface, and after it has set sufficiently hard shall be washed until the grit is exposed.

(2) The object of finishing is to improve the appearance of wearing qualities of structures. When

the float finish is given, the surface becomes dense and more impervious to moisture. The tooled finishes are used principally for artistic purposes, or when required by local municipal authorities. It is our experience that smooth finishes are less liable to catch and become discolored than tooled surfaces.

(3) The cost of finishing surfaces with a wooden float while concrete is green is about 10c. per square foot. After the concrete has hardened somewhat, and the use of a cement or a carborundum brick is necessary, the cost is increased to about 20c. per square foot.

The above average prices are for all labor and material, including any scaffolding required.

(4) As a general proposition, I think the best manner of finishing a concrete structure is by the wooden-float method, as it leaves the concrete in a more natural state, it is cheaper, and has a better appearance in the long run.

Application of cement on the surface or the use of a cement brick generally makes a white finish, which is more susceptible to discoloration and liable to wear away unevenly.

I think concrete surfaces should be finished in above manner whenever they are exposed, or where it is desired to obtain as much density as possible for waterproofing purposes. I do not think surfaces should be tooled, scraped or treated with an acid, except where the surfaces have been specially prepared and artistic finishes are required.

(5) I think surfaces finished smooth are less susceptible to discoloration from smoke and the weather than when untreated. However, tooled surfaces, I think, have the opposite effect.

(Concluded in next issue)

A New Method of Straightening a Leaning Factory Chimney

ONE of the most difficult and delicate problems with which an engineer can be confronted is that of straightening a tall factory chimney which has settled out of plumb. If the chimney must be kept in operation while the straightening proceeds, the difficulty and danger are increased. If the boilers are shut down while the job is being completed, the expense may be prohibitive, for this will mean the loss of output of the plant while the straightening proceeds. When a chimney is found to be out of plumb, therefore, it is highly desirable that a method of straightening it be found that will not require the shutting down of the plant, which will present but little risk, and which will prevent the recurrence of the original trouble. A novel method, fulfilling all these conditions, was devised by Thomas S. Clark and described by him in Engineering News. The problem was given to the Alphons Custodis Chimney Company, New York, with which Mr. Clark is connected, to straighten a 100-foot chimney in Brooklyn, N. Y., which had become 18½ inches out of plumb at the top.

The cause of the settlement of the chimney was a leak in a forgotten water pipe near the base of the foundation, which had softened the soil. The various methods which have been used for straightening leaning chimneys were considered and discarded as impractical under the conditions which existed.

To excavate on the low side of the foundation to the depth of the footing course, crib under it, and attempt to jack the structure back plumb, would have involved large cost, loss of time, and not a little risk. The great weight of the 100-foot column and the additional pressure due to the leaning would have required powerful jacks and a substantial footing to jack against. There would have been danger also of cracking the unreinforced spread foundation, and additional foundation would have had to be placed before the jacks and cribbing could have been removed safely.

A method employed in Europe is to saw out a wedge-shaped portion of brickwork on the side of the columns away from the direction of lean with an ordinary two-man crosscut saw, and allow the portion of the chimney above the cut to settle back. This method is not entirely satisfactory nor does it remedy the defect entirely, as the portion below the cut is still out of plumb and the bearing surface of the foundation footing is not brought to the horizontal.

As the chimney was in operation, it was not pos-

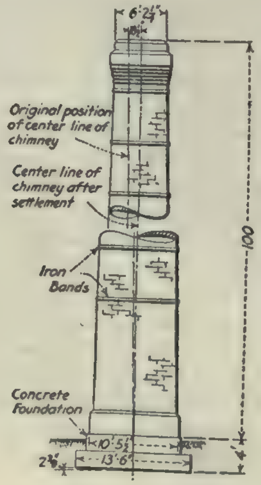

6'2¼"
Original position of center line of chimney
Center line of chimney after settlement
Iron Bands
Concrete Foundation
100'
4'
10'5½"
13'6"
2½"

Fig. 1.—The chimney out of plumb.

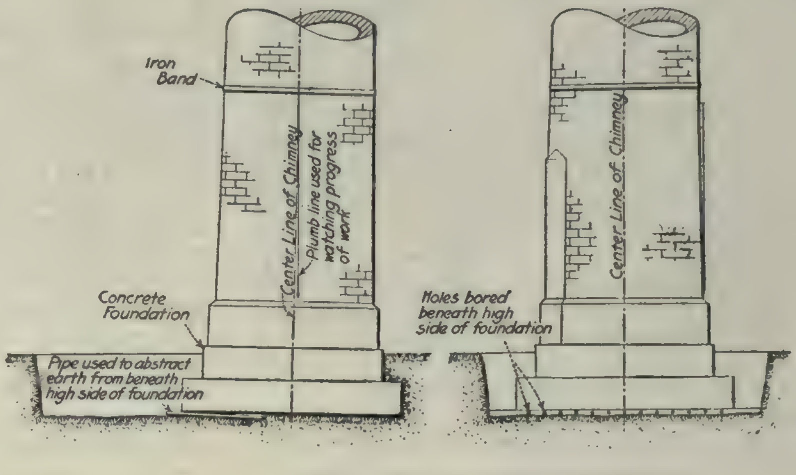

Iron Band
Center Line of Chimney
Plumb line used for watching progress of work
Concrete Foundation
Pipe used to abstract earth from beneath high side of foundation
Holes bored beneath high side of foundation
Center Line of Chimney

Fig. 2.—Method of straightening the chimney.

sible to determine the amount of its lean by plumbing to a centre on the inside. The deviation of 18½ inches from the vertical was determined with a transit by a simple triangulation. From this figure, with the known height of the chimney, it was determined that the toe of the footing on the high side must be settled 2⅜ inches on a line exactly opposite the direction of the lean. The problem was to remove just enough earth between the centre of the foundation and the toe of the high side to gradually settle the foundation back 2⅜ inches at the toe. Levels were taken on the high side and an indicating plumbline was fastened to the side of the chimney.

A trench next was excavated on the high side to the depth of the foundation, about four feet. The length of the trench was made equal to the square side, and its width equal to half the width of the foundation, or about eight feet. Four 2-inch wrought-iron pipes, 8 feet long (half the width of the foundation), were sharpened sawtooth fashion at one end. These pipes were successively driven under the high side of the foundation near its centre (Fig. 2), then withdrawn, and emptied of the material in them by driving a steel rod through the pipe. Successive insertions were made about a foot apart. As the pipes were withdrawn, the earth adjacent to the pipes crushed into the holes left by the withdrawn pipes.

In this way but a small quantity of earth was removed at a time, and but a small quantity gave way at a time; the yielding occurred just where wanted. The chimney settled back gradually, with no shock or danger. The amount of settlement, its direction, and the rapidity of settlement were always in absolute control. The telltale plumb-bob gave the direction, as well as the amount of movement.

At one period of the operation, the chimney began to settle slightly out of line. It was only necessary to drive the pipes more often at a certain point to bring the shaft back to line.

When the column was again plumb ,the trench was filled up. The underground leak in the drain pipe had been previously stopped to prevent further softening of earth on one side. The chimney has since remained intact.

Before the members of the Birmingham, Eng., Architectural Society, Mr. W. S. Purchon delivered a lecture on "Architecture and Efficiency." In studying the works of architecture of the past, he said, one ought not to look so much at the details and the trivialities as at the fact that the artists were striving to make the most efficient buildings they possibly could. It was not enough to take details from old buildings for modern works, but it ought to be realized that great structures of the past were really efficient solutions of special problems of the time and place, into which entered the climate, environment, and the needs of the time. Mr. Purchon referred to the importance of the public taking an interest in architecture. They should realize, he said, that architects were striving not only to make pleasing facades for buildings, but trying to make the best possible buildings from the point of view of utility and beauty.

From returns obtained by the American Railway Bridge and Building Association, it appears that of fifty-four leading railways in the United States and Canada only thirteen have not made use of reinforced concrete. The mileage of the forty-one systems on which this material is employed amounts to 138,784 miles, the reinforced concrete structures in use comprising arch bridges, trestle bridges, arch and box culverts, hollow and solid bridge abutments, bridge piers, decking slabs, retaining walls, and city subways. Some two hundred works are covered by the returns mentioned.

The "General Contractor." — A Painter's Viewpoint

By Thos. Truscott, in The Decorators and Painters' Magazine (London).

SINCE I am frequently asked the question, I may candidly admit I do not like him. Never mind how big in business he may be, he is a danger to the painting trade.

Let us see what he calls himself. He is a plumber, painter, decorator (ah, that word "decorator!") a joiner, a plasterer, bricksetter, gasfitter, and ever so etceteras; and he thinks less of the painting trade than of any other, possibly because he knows least about it.

He will talk airily of "slapping" a bit of paint on, and will cheerfully suggest you "shove" a bit of putty where he thinks it may be wanted.

As a rule the "general contractor" is either a builders' clerk "on his own," a joiner or a plumber; but of painting he knows next to nothing.

You, perhaps, are a really genuine painter, having studied your trade from boyhood; but when you are called upon to estimate against this "general contractor" you stand aghast—unless your limbs happen to give way. He takes the painting at a price which, if you worked for sixpence per hour, would not pay your account for materials. Why?

He has the whole of the job. He makes a "bit" —and those in the know will tell you it is a good "bit," too—out of fixing ovens and grates. Or possibly he will have the job of repairing the roof. Twenty slates are wanted; two are put in; if a hundred are wanted he puts in eight or ten. Any of the old ones that are chipped he simply reverses.

And as to his plumbing, what a profit there! His lead when out of touch and sight is that thin it quivers in the slightest gale. It is by such means he gets his profits, and is thus enabled to cut you out of the painting.

But he is a handy man for the owner and the architect. He will plumb, paint, join, plaster, stick on bricks, put up your grates and your gasfittings; and in doing all this he saves the architect from getting separate prices for the various branches. And it is against this that you should fight.

Often he calls himself simply a "builder and contractor." He takes every branch of the building trade and, as I said, thinks less of the painting branch than of any other. Anyone in his opinion can "slap on" paint. He will tell you frankly he gets more out of his jobber, or joiner, or bricksetter, than out of any painter, for the simple reason he does not know what painting is.

So, if you work for architects, here is a chance for you to point out the unfairness of it all. Let the plumber be a plumber and naught else, and the joiner a joiner; but the painting should be a distant and separate trade, managed by genuine painters only.

General view of excavation for filter, showing intake pipe (on the left) leading up to the pump house.

Slow Sand Filtration at Port Hope, Ont.

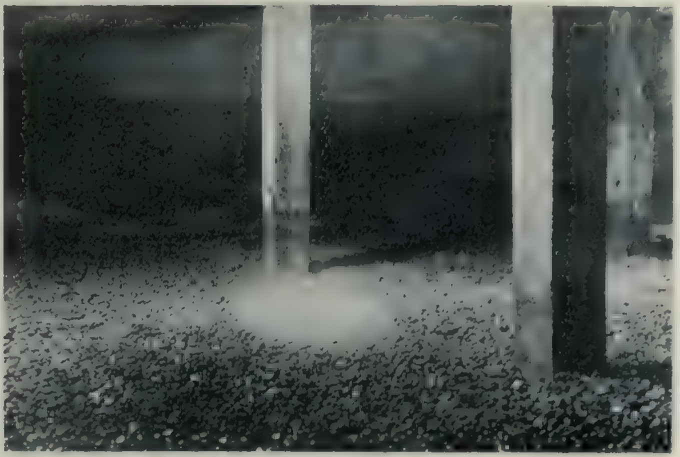
IN November of last year the Board of Water Commissioners of the town of Port Hope decided to install a system of slow sand filters in connection with a direct intake into Lake Ontario. Plans were prepared by the Engineers, the F. W. Thorold Company of Toronto, and tenders were called for in March of this year.

The method of slow sand filtration was adopted after a careful comparison with mechanical filters of both the pressure and gravity type. Until this year, the water for the town was obtained from three infiltration wells and a filter gallery, built close to the shore of Lake Ontario, there being no direct connection to the lake. The quantity of water obtained from these wells had been getting less and less each year and there was also evidence of some pollution from the town side.

The plan adopted utilized the largest of these infiltration wells as the excavation for a set of four slow sand filters. An intake pipe projecting 1,800 feet into Lake Ontario was brought to the low lift pumping station placed alongside the filters. The water from the lake will flow by gravity to the pump well in this pump house, and will then be allowed to flow or may be pumped into any one or all of the four filters. After passing through the filters, the water flows through four Venturi meters to a pure water reservoir, constructed of concrete. From this it flows to the pump well, in connection with the old pumping station and is then pumped, as formerly, into the town mains and standpipe.

As a general rule, the cost of slow sand filters does not show well in comparison with filters of the mechanical type, and it was only because sand and suitable gravel could be obtained in the immediate vicinity that this type of filter could be adopted in Port Hope. The filters are constructed entirely of reinforced concrete, and are of monolithic construction. Each filter is 47 feet square. The daily capacity of the filters, at a rate of 3,000,000 gallons per acre per day, will be 600,000 gallons. The concrete bottom of the filters rests on hard pan, and is reinforced in both directions. There are nine columns in each filter, and the floor is laid so as to form gutters running in both directions between the columns. The roof, and beams supporting it, are reinforced with steel. Split tile pipes are laid in the gutters in the floor of the filters. These are covered with 6-in. washed gravel varying in size from 1 in. to 2 in. On top of this is a layer of 3 in. of gravel, carrying from ¼ in. to 1 in. This again is

Port Hope filtration plant: the work shown above a few months later.


Inside one of the filters after the coarse gravel had been laid.

Form work for columns in place.

covered with a 3-in. layer of gravel from 1/20th to ¼ in. This gravel bed is then covered with 42 in.of screened, graded and washed sand.

The pump house contains a vertical motor, direct connected to a centrifugal pump having a capacity of 600 gallons a minute. There is also an auxiliary Fairbanks oil engine, chain belt connected to a horizontal centrifugal pump having a capacity of 800 gallons per minute. There is another horizontal motor and pump connected to the under drains from the filters to assist in washing. It will not be necessary to use the pumps excepting during low water.

When cleaning filters the top inch of sand will be washed and returned to the filters by use of a sand ejector and sand washer, supplied by Mr. Fred. Henning of the Toronto Filtration Plant. The top inch of sand in the filters is gathered into piles and shovelled into the sand ejector, from which it is carried by water to the Henning washer. This washer separates the sand from its impurities, the clean sand being carried back to the filters and the impure sand being discharged to waste in the one operation. All of the sand which has been placed in the filters has been passed through this washer.

The contract for the filters was awarded to Messrs. Thos. Garnett & Sons, of Port Hope. The Fairbanks-Morse Company, of Toronto, supplied the pumps and engine, and Mr. John F. Boyd, of Sault Ste Marie, had the contract for laying the intake pipe. The pipe itself was supplied by Messrs. Francis Hankin & Co., of Toronto, while Messrs. Drummond McCall Co., of Montreal, supplied the valves.

The cost of the plant will be well within the amount of the estimate submitted by the engineers.

Hypochlorite conversion tables, devised by the Engineering Department of the Denver Union Water Company for calculations after each hourly reading, disclose the fact that the amount of hypochlorite applied hourly in pounds per million gallons of water per day, the latter a nomenclature recommended by the New England Waterworks Association in preference to grains per gallon or parts per million, is nearly identical with the calculated parts per million of available chlorine when the latter is 36 per cent. of the total amount of hypochlorite used. For example, when 0.30 lb. is applied hourly to a weir box on which the reading is 1,000,000 gal. daily, the equivalent parts per million of available chlorine is 0.31.

Port Hope filtration plant, showing completed pump house and the roof under way.

Western Section of Grand Trunk Pacific

The completion of this, Canada's second transcontinental railway, has afforded a writer in the Engineering News topic for concise and interesting comment. There is a total rise of 2,938 feet from Winnipeg (785 ft.) to the Rocky Mountain summit at Divide (3,723 ft.), and a fall of 3,705 ft. from Divide to the terminal at Prince Rupert (31 ft.). For operating, the line is divided into 14 divisions, or train districts, and the characteristics of these are shown in the accompanying table.

The remarkable feature of the profile and the location is the low grade secured through the Rocky Mountains, this being 0.4 per cent., with the exception of a 20-mile pusher grade of 1 per cent. For the entire line the maximum grade is 0.4 per cent., with an aggregate of a little over 100 miles of 0.5 per cent. The latter grades are against westbound traffic only, and the heavier traffic will be eastbound. The 1 per cent. pusher grade (against eastbound traffic) is on division No. 9. The changing character of the country is indicated by the change in curvature. For the first five divisions from Winnipeg (to Wainwright, 670 miles) the maximum curves are 3 deg. For the next two divisions (to Edson, 250 miles) this is increased to 4 deg., while on all the remaining seven divisions, 825 miles to the coast, the maximum curvature is 6 deg.

The maximum elevation above sea level is 3,723 ft. at the Continental Divide, in the Yellowhead Pass. About 30 miles beyond this, along the Fraser River canyon, comes the sharp fall of the 20-mile pusher grade. There is also a summit elevation of 3,560 ft. at Obed, on the same division. The Canadian Pacific Railway reaches an elevation of 5,330 ft. at Stephen and 4,330 ft. in the Rogers Pass, with grades of 2.2 per cent. in both cases (originally 4.2 per cent.). The Canadian Northern Railway will use the Yellowhead Pass, and practically parallel the Grand Trunk Pacific Railway for about 250 miles from Edmonton.

The railway has been provided mainly with permanent structures, but there are a few wooden bridges of comparatively temporary nature which will be filled from time to time. There also remains the construction of additional stations, section houses, and similar facilities as these become necessary with the development of the traffic. Division points, with the exception of that at Prince Rupert, have all been supplied with roundhouses, shops, coal and water-handling plants, etc. The railway is in good condition for traffic, but (as on all new lines) considerable additional ballasting will be required where settlement occurs. This work will be done from time to time, and a further lift of ballast will be given over the entire line after traffic has thoroughly settled the roadbed.

Characteristics of the Grand Trunk Pacific Railway

			Ruling Grade, Per Cent.					
			West-bound		East-bound			
Train District	Elev. Above Sea Level, ft.	Miles	Per Cent.	Mi.	Per Cent.	Mi.	Level, Mi.	Max. Curve, Deg.
1. Winnipeg (785 ft.) to Rivers	1568	142	0.5	17	0.4	1	36	3
2. Rivers to Melville	1812	137	0.5	14	0.4	18	26	3
3. Melville to Watrous	1782	129	0.5	19	0.4	35	10	3
4. Watrous to Biggar	2150	118	0.5	27	0.4	19	15	3
5. Biggar to Wainwright	2252	140	0.5	27	0.4	36	22	3
6. Wainwright to Edmonton	2205	125	0.4	29	0.4	35	20	4
7. Edmonton to Edson	2984	128	0.4	48	0.4	16	13	4
8. Edson to Jasper	3460	104	0.4	38	0.4	26	14	6
9. Jasper to McBride	2360	107	0.4	20	0.4	37	22	6
	....	pusher	...	..	1.0	20	..	..
10. McBride to Prince George	1870	144	0.4	18	0.4	36	32	6
11. Prince George to Endako	2245	116	0.4	24	0.4	7	36	6
12. Endako to Smithers	1640	127	0.4	4	0.4	28	26	6
13. Smithers to Pacific	385	105	0.4	4	0.4	67	15	6
14. Pacific to Prince Rupert	31	120	0.3	1	0.4	11	72	6

Construction was commenced in 1905, and has been under the direction of Mr. B. B. Kelliher, Chief Engineer. He resigned his position in the fall of 1914, and the work is now under Mr. H. A. Woods, who has been Assistant Chief Engineer for several years.

Points on Paint

Good painting work may be accomplished by—

(1) Having all under coats harder than the following outer coats.

(2) Allowing ample time between the coats for the maturing of all surface inequalities and defects.

(3) Having all paint as nearly as may be an integral part of the surfact painted.

(4) Good workmanship—and having all undercoats well brushed in.

(5) Using good and suitable materials, and avoiding false notions of economy both in labor and materials.

(6) Proper inspection of materials and workmanship.

WILL Britain suffer loss of financial prestige through the European war? There are some in financial circles in New York who think so. Yet London has scarcely felt the shock, so far. True, Britain has paid out immense sums for war materials, but it is chiefly with loans from her own people. The interest obligations are high but these go back into the pockets of Britishers. Then, too, Britain has been lending freely to her allies. This involves a closer commercial relationship after the war is ended, which is bound to bring her extensive trade. It is estimated that Britain has $20,000,000,000 invested abroad. Only a meagre proportion of this has been liquidated. Meanwhile Germany is issuing paper money at a pace that would cause anxiety to the most reckless financier.

A suggestion that is well deserving of the attention of the Militia and Defence Department is that a Canadian Board of Engineers be created for the purpose of examining and pronouncing upon inventions designed for military use. Such a board was constituted by the British Government soon after the Munitions Department was established. It is presided over by Lord Fisher, who a short time before resigned the office of First Sea Lord. Like every other phase of the will to conquer in this country, inventive ingenuity has been greatly stimulated by the war. Among the many men in Canada who have a turn for invention there are doubtless some of really creative capacity, and if even one important new instrumentality of war could be sifted out of the many devices that would be submitted it might well repay the labors and cost of a Board of Engineers.

Because of the swampy condition of the western part of Holland it has been necessary to use wooden piles for foundations for houses, viaducts and other structures. Until lately the use of concrete in connection with these foundations had not been thought of, but a recent trial at Westerdok demonstrated the practicability of the reinforced concrete pile and, as a result, the system of building foundations in this part of Holland is rapidly changing.

Cost and Economy of Cement-Concrete Pavements

By H. E. Hiltz[*]

IN view of the fact that the cost of various types of pavement has not been given the consideration it merits, the Association of American Portland Cement Manufacturers has been gathering information which would lead to reliable conclusions as to the cost of cement concrete pavements. The information gathered in the field has been tabulated so that it may be analyzed for use.

In the reports turned in weekly by our representatives on contracts, the cost has been divided into five major items:—labor, teaming, mechanical equipment, materials used in constructing the pavement, and miscellaneous items. For reference purposes the cost of various items has been reduced to cost per square yard of pavement.

In the tabulation the labor is sub-divided according to where it was used—as at sand pit or washer, on sand at the work, on stone at the cars or quarry, at or near the mixer (which includes wheeling and shovelling and actual mixer work on the sub-grade), and in the construction of the pavement. It also includes superintendence, watchman, timekeeper, foreman, etc. The tabulation also gives the amounts of material handled. From this the amount handled per man per day can be readily obtained.

The item of teaming is dealt with in the same general manner, and is sub-divided so that cost may be obtained whether teams, traction engines, or industrial railways are used. As in labor, the cost is sub-divided and tabulated, and the cost per square yard of pavement carried out.

The actual quantities used in construction are shown. These can be checked by computation from the cross-section.

The cost of the materials at the job, exclusive of haul, is given. It is also shown as cost per square yard of pavement.

The miscellaneous items are naturally small, but for close figures they have been included where practicable, and likewise reduced to cost per square yard of pavement.

During the year 1914 ninety-five contracts were worked up along these lines, and the average costs of work in various States are tabulated below. A perusal of these figures justifies us in stating that it would pay the contractor to tabulate costs in the general manner outlined, as such detailed figures would surely show him how to place his men or gangs so that they could work more efficiently.

It may seem to some that this method is too detailed to allow of practical use in every-day construction. It is interesting to note that in one particular road, picked at random, approximately five miles long, the contractor's price per mile for concrete pavement was $13,370. The bid price was $5.50 per cubic yard. Nearly 1,600 cubic yards of concrete were used per mile of road. Thus the contractor received $8,745 a mile for concrete alone. Cost data sheets showed very clearly that the concrete was costing about $9,350 a mile. The contractor was, therefore, losing $605 a mile. These cost data are easily obtained.

It is rather difficult to make specific recommendations concerning a basis of comparison for economy between concrete pavements and those of other materials. The selection of a type of pavement depends upon three major items: first, the traffic which is at present passing over the highway and whether or not the improvement will make more traffic seek the road; second, the first cost; third, the yearly cost of maintenance.

Many well-known engineers have given as their opinion, as to future traffic conditions, that it is unwise to be conservative, in view of the fact that the intensity of traffic is increasing at such a rapid rate, and that the speed and wheel loads of vehicles are becoming excessive. They have in mind the troubles experienced by the present-day bridge engineer who is repeatedly called upon to strengthen both railway and highway bridges scarcely a dozen years old. It is not uncommon to see twelve-ton trucks tearing along our various trunk-line roads at a speed of even fifteen miles an hour. Such loads are generally considered excessive and many would impose laws restricting both wheel loads and speed. To me it seems but logical and economical rather than to limit the loads to so construct the roads that they are capable of sustaining these increasingly heavier loads.

Economy in the broadest sense also dictates that within limits the pavement should be such as will serve all classes of traffic.

Owing to its low tractive resistance, and the excellent foothold obtainable, a horse can pull a much larger load over a concrete pavement than over any other type. This is of vital importance to farmers and haulers of heavy and comparatively low priced commodities. In addition to this the concrete pavement is eminently satisfactory and economical for motor-driven traffic. In this connection it is interesting to note that Mr. Rollin W. Hutchinson, Jr., says that in 1913 about 36,000 motor trucks were made in this country, or 6,000 more than the entire history of the industry had up to then recorded. This history indicates that the number of trucks going into service may be doubled each year until highway commerce becomes completely motorized.

If the experience gained by European engineers is any criterion, the highway problem in the wealthier States will be mainly a question of maintenance within the next ten or twelve years.

Much has been written concerning the maintenance of pavements, particularly those of the so-called permanent type. It has been stated repeatedly that the average cost of maintenance on roads improved ten or twelve years ago has been $400 to $600 per mile per year. It has also been stated by highway engineers in some of the eastern states that their maintenance costs have run as high as $1,000 per mile per year.

In dealing with the maintenance question as it is before us to-day, we cannot use average figures which were obtained even five or six years ago; therefore we should not be concerned with the average cost of maintenance. What we should be concerned with, however, is the rate of increase in maintenance costs.

It is the concensus of opinion among a great many

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[*] Road Engineer, Association of American Portland Cement Manufacturers.

Sample Weekly Report*

	No. Hrs.	Wages per hr.	Total Cost	Total Am't Handled	Cost per c.y.	Cost per c.y. Pavement
On Sand at Work	42	$.171	$7.18	56.5 cu. yd.	$.127	$.009
On Cement at Work	84	.171	14.36	37.6	.382	.018
On Stone at Work	84	.171	14.37	113.0	.127	.018
Wheeling Sand at Job	30	.175	5.25	55.5	.093	.007
Wheeling Stone at Job	90	.175	15.75	113.0	.139	.020
On Mixer, Loader	20	.175	3.50	37.6	.093	.004
1 Engineman	10	.250	2.50	135.0	.019	.003
1 Engineman	10	.250	2.50	135.0	.019	.003
Chute or bucket	10	.175	1.75	135.0	.013	.002
Sub. Grade before Mixer	30	.176	5.28	135.0	.040	.007
Leveling Concrete	20	.175	3.50	135.0	.026	.004
Templet Men	20	.175	3.50	135.0	.026	.004
Finishing Pavement	20	.175	3.50	135.0	.026	.004
Forms, Joints, Sacks and Removing Forms	40	.187	7.48	135.0	.056	.009
Wetting Pavement	10	.165	1.65	135.0	.012	.002
Covering New Pavement	30	.165	4.95	135.0	.037	.006
Superintendent	10	.450	4.50	135.0	.033	.005
Watchmen	12	.175	2.10	135.0	.013	.003
Timekeeper	10	.200	2.00	135.0	.014	.003
Foremen	10	.400	4.00	135.0	.030	.005
Water Boy	10	.125	1.25	135.0	.009	.002
Cleaning off Pavement	30	.165	4.95	135.0	.037	.005
					1.371 Total	.145

Teaming.	No.	Cost per day	Total Cost	Average Haul or Pump	Amount Hauled or Pumped	Cost per c.y. Mile or 100 Gal. Mile	Cost per c.y. at Job	Amt. per s.y. Pavement	Cost per s.y. Pavement
Sand	11	$36.80	16.80	3900	56.5 c.y.	$0.402	$0.297	.070	$.021
Stone	22	36.80	45.00	3900	113.0 "	0.398	0.398	.1 1	.030
Cement	9	36.80	18.40	3800	37.6 "	0.489	0.480	.048	.023
Water			3.55	5000					
							Total		$ 104

Mechanical Equipment.	Cost of Plant	Int. & Deprec. of Plant 0.00154 x cost	Cost of Labor	Cost of Supplies	Amt. Rol'd, Pumped, etc.,c.y.	Cost per s.y. Pavem't
Steam Roller	Rented	Rental $3.00	3.00	1.00		0.090
2 Wheel Scraper	$50.00	Dep. 0.07				
4 Slip Scraper	60.00	" 0.09				
Pumps	Rented	Rental 0.30	1.75	1.50		0.004
Mixer	1800.00	Dep. 2.77	6.75	4.00	135	0.020
Forms	50.00	" 1 00				0.001
Barrows, Boxes, etc.	36.00	" 0.25				
Dinkey Eng. and Equip.	5000.00	" 7.70	4.15	1.00	207	0.020
					Total	.135

Theoretical.		Per Unit Cost	Average Haul	Cost of Haul	Total cost at Job Ex. of Haul	Cost per s.y. of Pavem't
Cement	257.5 bbls.	1.25 F.O.B.Cars				
Sand	54.3 c. y.	0.75 F.O.B Cars 1.70 C.Y. Pit				
Stone, gravel.	108.6 c. y.	0.90 F.O.B Cars 1.80 C.Y.Pit				
Actual.						
Cement	268 bbls.	$335.00	3900	$18.40	$335.00	$0.420
Sand	56.5 c. y.	96.05	3900	16.80	96.05	0.120
Stone, gravel.	113.0 c. y.	203.40	3900	45.00	203.40	0.254
Steel. Wooden Joints	15	9.00			9.00	0.011
Tar paper						
Steel, Reinforcement						
Miscellaneous Items.						
Stripping Sand Pit						
Freight on Equipment						
Miscellaneous Teaming		5.00				0.006
Oil, Coal, Gas. Repairs						
Labor, Unloading Mixer, Laying Pipe, Lost Time						
					Total S. Y. Road	0.811
					Grand Total	1.295

Notes:	Totals
Labor	.145
Teaming	.104
Mech. Equip.	.135
Materials	.811
	$1.295

Cross Section 4¼"—6¼"—4¼" by 16'.

Equipment: 1 Ton Roller (16); 1 Dinkey and Equipment; 2 Wheel Scrapers; 4 Slip Scrapers; ½H.P. Pump.

There are twenty men employed in unloading and loading materials, taking up track and doing odd jobs. In the above report the time is charged against labor and is again used in finding cost per cu. yd.—mile, but this labor charge enters but once into the grand total.

$1.171, $0.187 and $0.176, are taken as an average wage of men included.

engineers that a concrete foundation is a good investment and that it is wise and economical to provide such for all types of pavements on heavy traffic streets. It is interesting to note a comparison of costs of approximately 80 miles, 16 feet wide, 1:1½:3 concrete pavement, and 35 miles, 16 feet wide, 1:2½:5 concrete foundation. The average bid price for the concrete pavement was $1.06 per square yard, and the average bid price for the foundation was $0.84, showing a difference of $0.22 per square yard in favor of the concrete foundation.

When one takes into consideration the fact that the concrete pavement, when properly constructed, has a life of at least twenty years, with minimum maintenance charges, and that its surface can be made as non-slippery and smooth as that of any other type, does it not seem that the builders of concrete pavements are looking far into the future and that their investments are wise inasmuch as the concrete pavement at the end of its life may be made the foundation for any other type?

Methods Used to Waterproof Bridge Floors*

THE first of the solid steel-floor bridges with which the writer had any experience was built between 1903 and 1906. The floors of the deck bridges were made of channels, with the flanges up and rivetted together. The floors of the through bridges were of the ordinary trough type. With both through and deck bridges enough concrete was placed to provide good drainage. In most cases, the water was run off the bridges at one end, as they were on heavy grades. Plates were turned down over the back-wall, and, although fairly good drainage was provided, this construction did not prevent the water from finding its way through the back-wall and down over the face of the abutment. No waterproofing was placed on the deck, and it was soon found that the ballast would have to be removed, and waterproofing applied. The water found its way down through numerous cracks formed in the concrete on top of the solid steel floor.

Five-ply felt, with brick protection, was used later when these structures were waterproofed. This waterproofing has eliminated the leakage through the floor system, but there is still some trouble with seepage through the back-wall and over the abutment. Where this trouble was serious, the nuisance, to a great extent, has been eliminated by constructing a copper gutter along the abutment under the bridge seat.

In 1907 there was built on the Delaware, Lackawanna & Western Railroad a six-track deck girder bridge, with a reinforced concrete floor 84 feet wide and 349 feet long. The bridge is at the neck of a yard with numerous crossovers and slip switches on the bridge, so that the floor had to be sufficiently strong to permit the maximum loading at all points. A reinforced concrete deck, 1 ft. thick, was placed directly on top of the girders. Drainage outlets through this floor were provided at low points in each 814 sq. ft. of surface. As the bridge was rebuilt under traffic, the floor could be built for only two tracks at a time. A ridge in the concrete was made at the construction joints to prevent leakage, but no waterproofing was applied. Although this floor was built and put in service seven years ago, it is in good condition to-day, and no leakage has occurred. Other bridges have since been built in the same manner and with equally good results. In one case, in 1908, the writer built a deck girder bridge, 91 ft. wide, with a clear span of 60 ft., over a city street, with a reinforced concrete floor, without the application of waterproofing. The floor is in perfect condition to-day, and has never leaked a drop; neither has any water found its way over the back-wall to the bridge seat. The floor is 16 inches thick at the centre and 13 inches at the ends, and the slab extends past the back-wall, with a groove in the underside to intercept the seepage.

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* This report is completed on an average day of 450 feet between September 25th and October 1st, inclusive.

* G. J. Ray (Chief Engineer, Lackawanna and Western R. R.) in Engineering and Contracting.

At first, the writer had some doubt as to the success of the last-mentioned construction over city streets, as there is no question about the destructive tendency of water in passing through concrete. Therefore, nearly all the solid-floor bridges on this road have been waterproofed, regardless of the type of construction. During the past five years, this company has built deck girder bridges over city streets with concrete slab floors, also numerous through girder ballast-floor bridges with reinforced concrete slabs over the floor system, and also with the entire floor system—or bridges as a whole—encased in concrete. As a rule, the concrete for one or more tracks is poured complete in one operation, thus avoiding construction cracks at points where leakage is likely to occur. Where construction joints are necessary, copper flashing strips can be built into the concrete on each side of the joint, thus eliminating the leakage. These bridges, as a rule, have been waterproofed with five-ply felt, with brick protection, or with treated burlap and asbestos felt with asphalt mastic protection. There have been only a few leaks with either method, and up to date no trouble has been experienced from leakage through the sliding joint between the floor slab and the back-wall. A double layer of treated felt or cotton drill has been placed in this joint with good results, and in all cases great care has been taken to extend the waterproofing at least 18 inches down over the back-wall, and to provide a good drainage system to carry off the water.

The only indication of water passing through the floor system has been a very slight seepage in a few places along the girders where the steel was painted prior to the construction of the concrete floor. The writer believes that the surest way to prevent this trouble is to eliminate painting of steelwork which is to be covered with concrete.

With long structures, Mr. Wagner's method of taking care of the drainage should produce good results where the drain pipes can be connected directly to the sewer, without traps, so that the pipe will not freeze during cold weather. With short bridges over city streets, it is difficult to maintain longitudinal drains under bridge floors, and down-spouts at abutments to street sewers. With a temperature of about 32 deg. F., ice and snow will melt on the bridge floor and freeze in the leaders and drains under the bridge. The difficulty is not so great where columns are placed on the curb line, and down-spouts can be carried directly to the sewer by vertical pipes. It will be found, however, that in cold climates such drains are constantly freezing, and are a source of expense to maintain.

Where columns are permissible on the curb line, the writer has used steel construction encased in concrete for the long span over the paved portion of the street and reinforced concrete slabs over the sidewalks This construction permits of a perfect job of waterproofing, and eliminates any possibility of water getting down the face of the abutment from seepage through the back-wall. In such cases, the columns have been constructed of concrete; the depth required from the top of the rail to the under clearance does not exceed 4 ft. 7 ins. for spans up to 50-ft. centres. This type of construction, as a whole, is not unreasonably expensive. The encased steel-work is costly, but the slabs over the sidewalks are economical, on account of the short spans, and the thickness of the abutments can be reduced materially. Standard track centres can be maintained by keeping the centre girder shallow. Painting is entirely eliminated, and the design can be made ornate enough to please the most skeptical critic.

On eight through girder bridges recently constructed, the cost of the concrete floor, including reinforcement and encasement of I-beams, averaged 35.6 cents per square foot of floor space. These bridges varied in length, centre to centre of bearings, from 53 feet 8 inches up to 120 feet 7 inches, and in depth, from top of rail to under clearance of girders, from 3 feet 8 inches to 4 feet. All waterproofing was done with three-ply treated burlap and asbestos felt, protected with asphalt mastic, 1½-in. thick. The average cost of the waterproofing was 28 cents per square foot, thus making the entire cost of the floor system 63.6 cents per square foot, exclusive of the structural steel.

In an address at the recent annual meeting of the American Federation of Arts in Washington, Mr. Charles R. Ashbee, M.A., F.R.I.B.A., speaking as an English architect and art worker, deplored the effect of the war on British industrial art. He said that just before the war he had worked out a plan by which a laborer's cottage could be designed and built for a thousand dollars, just the amount that it costs to fire a 16-in. gun. Now no cottages are built and millions of money are shot away on the battlefields. Mr. Ashbee's workshops are all closed, three of his workers are at the front, a fourth is drilling cavalry, another is learning to drop bombs from an aeroplane, and another, "the best enameller in England," is making cartridges.

Skewed joints for concrete roads, instead of joints at right angles to the direction of traffic, are recommended by C. H. Moorefield and James T. Voshell, of the U. S. Office of Public Roads, in Bulletin 249 of the Department of Agriculture. With the joint at right angles the two wheels of a vehicle strike the joint at the same time and thus produce the maximum amount of impact. By skewing the joint at an angle of about 15 deg. the wheels strike one at a time, and the total resultant impact is reduced by at least one-half. This is advantageous to both the traffic and the pavement, and since the difficulties involved in constructing skewed joints are not at all serious, there is no apparent objection to their use, are opinions expressed by the bulletin.

Cleaning with hand brooms has been found cheaper in Victoria than sweeping with horse brooms. In 1913 the cost of cleaning with horse brooms and disposal of sweepings was 33.9 cents per thousand square yards, with hand brooms 26.9 cents, and with brooms and pick-up cans 21.5 cents. In 1914 the cost with hand brooms and pick-up carts and cans was 16.5 cents. These costs do not include rental or overhead charges.

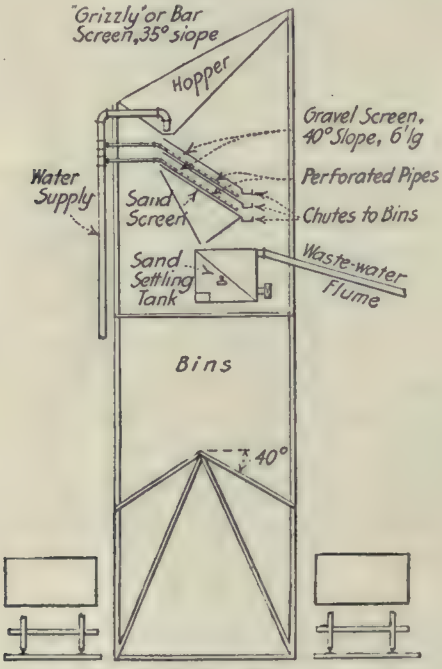
Screens for Gravel Washing and Screening*

THE method of screening, and the type, size and arrangement of screens depend very largely upon the character of the pit-run material, the grades of material it is intended to produce, and whether or not the material is to be dry screened or screened with water.

Dry Screening.—It is practically impossible to screen dry material by means of gravity screens. The revolving cylindrical screen is the only type of screen suitable for dry screening, and its effectiveness will largely depend upon the amount of moisture in the material and the percentage of sand in the gravel.

With dry material not containing an excessive amount of sand, fairly good results may be obtained. If the material is moist or wet and the percentage of sand high, however, dry screening will prove anything but satisfactory.

Gravity Screens.—Where the material is excavated from a wet pit, such as rivers and creeks, and reasonably clean, a very fair degree of screening can be obtained with the simple inclined gravity screen, provideed plenty of water is used on the screen plates.



An effective gravity screen.

To produce the best results with the gravity screen, the gravel should be composed of well-rounded stones. Even under such favorable conditions, however, the percentage of oversize material in the several grades produced is apt to be quite high. If the market requirements or specifications for the material will not permit of at least ten per cent. oversize, gravity screens should be adopted with caution. If the deposit contains a very large percentage of long, flat, angular stones, it will be practically impossible to screen material without a very large percentage of oversize.

Where the above conditions are favorable and the specifications for the material will permit, the gravity screen is the simplest and most economical one that could be used. An objection to this screen is that it is practically impossible to take out or separate all of the sand from the gravel, at least 10 per cent. to 15 per cent. of the sand going in with the gravel, even under the most favorable conditions. Where the requirements, however, are for a road gravel or what is known as a concrete mix, in which a certain percentage of sand is required, this objection does not obtain, and a very fair grade of such material can be produced with this type of screen.

The accompanying sketch shows a very effective gravity screen arrangement used in connection with a dragline cableway excavator. The material is dumped by the excavator directly upon the "grizzly" or bar screen, the material rejected by this screen going to the crusher or waste pile. The material going through the bar spacings is fed directly from the hopper to the screens.

While the usual practice is to discharge the entire water supply for washing directly upon the material in the hopper, much better results have been accomplished by delivering at least one-half of the supply directly upon the screens by means of perforated pipes.

In sliding over gravity screens, the material acquires a velocity in a very short time the prevents it from going through the perforations. Nothing is accomplished, therefore, in using screens longer than 6 feet.

It is advisable to make the screens in sections, so as to permit of easy handling. The screens should also be at least 2 feet apart, so that repairs and renewals of any of the sections can be easily and quickly made without disturbing the other screens. The initial screen should be a bar screen. The sizing screen should be of either heavy, square-mesh wire or perforated metal. If perforated metal is used, the perforations should be spaced somewhat closer together than is ordinarily the practice in a revolving screen plate.

Sand Screens (Gravity Type).—The shape of the sand grains, whether round or long and angular, shape and size of screen perforations, manner of applying water to the screen, amount of water and inclination of the screen, all have their effect upon the efficiency of the screen. If the sand grains are round, it is generally advisable to use a slotted perforated plate for the sand screen, as with round or square perforations the screen is likely to clog. If the grains are long and angular, however, it is generally advisable to use a round perforation in steel plate or a wire mesh screen. For this purpose No. 11 wire for the coarse and No. 16 wire for the fine sand screen have proven effective.

Water Required for Gravity Screens.—The amount of water required varies with the amount of impurities in the gravel, but where this method of screening can be used at all a supply of at least 1½ gallons per minute per cubic yard of material screened per day should prove effective. A larger amount of water is required with the gravity screen than with the revolving screen; but, inasmuch as an ample water supply at comparatively low cost is generally assured where wet material is being handled, this feature is of no particular importance.

Settling Tanks.—The sand is separated from the dirty water by means of settling tanks, which permit the dirty water to flow off, the sand discharging itself through an opening at the bottom. The practice of spouting the sand and dirty water to large open storage basins and permitting the dirty water to escape by flowing through and over the sand, results in a dirty sand, the action being similar to that of a sand filter. The writer would not recommend the use of gravity screens for washing and screening bank or dry material, as he has yet to see a gravel from a dry deposit that could be effectively washed and screened by means of gravity screens.

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*Abstract of article by W. H. Wilms in Engineering News.

Revolving Screens.—Where the clay, loam or other impurities in the gravel can be easily washed out, any one of the several types of revolving screens will produce satisfactory results, so far as screening and washing of the material is concerned. If the material is dirty, however, and the gravel covered with a hard film of dirt, effective washing is impossible in any screen. In such cases some form of preliminary washing and scrubbing is absolutely necessary before the material is permitted to enter the screens.

The ordinary cylindrical screen with a steel cylinder extension at the head, or feeding end, of the screen for effecting this preliminary washing has proved an efficient and economical unit for the screening and washing of dirty material. Lengthwise of the inside of the washing cylinder are lifting blades, which by the repeated lifting and dropping of the material in a bath of water loosens and scours off the clinging impurities.

Speed of Screens.—For the most effective screening of gravel, revolving screens should have a peripheral speed of about 140 feet per minute. The speed of the sand screens should be from 20 to 35 feet per minute greater.

Corrosion of Iron and Steel Water Mains

By W. J. F. Binnie

INTERNAL corrosion and incrustation of the pipes, he said, caused a material reduction in their carrying capacity, especially with the soft moorland water of the northern countries. This had to be allowed for by designing the pipes of such diameter that they should still be able to pass the required quantity of water, even after incrustation had taken place. Although incrustation could be removed by mechanical means, the protective coating could not be restored, and once scraped, the pipe deteriorated rapidly.

The economic bearing of corrosion was even more important in the case of steel than of iron, as, owing to the smaller thickness of the pipes, the loss by corrosion represented a much larger percentage loss of strength.

It had long been known that, for the corrosion of iron, water and oxygen were required, and, according to the older chemical theory, the presence of an acid was also necessary. This was usually found in the carbon dioxide present in the air and water.

According to this theory, this carbon dioxide combined with the iron to form soluble ferrous carbonate or ferrous hydrogen carbonate. The oxygen of the dissolved air then converted the soluble iron salt into ferric hydroxide, which was deposited as rust and liberated carbon dioxide, which was free again to attack the iron; and so the process was repeated until protection might be found by the deposition of rust on the iron. It appeared from later experiments that acid was not necessary if dissolved oxygen were present in the water, and an electrolytic theory was put forward.

According to this, the water contained free positively-charged hydrogen ions. The hydrogen ions tended to combine with the dissolved oxygen, but could not do so until they obtained a negative charge. This they obtained from the iron which was changed into the ionic state, combining with the hydroxyl ions to form ferric hydroxide, or rust.

According to some experimental evidence, however, corrosion did not take place when all traces of CO_2 were removed, even if the dissolved oxygen be present. The matter was a controversial one, but the author declared that the balance of opinion was in favour of the electrolytic theory.

A biological theory had also been put forward, attributing corrosion to the action of organisms; but, as corrosion took place under conditions that inhibited life, this explanation was improbable; although it was possible that the acid secretions of organisms in the water might accelerate corrosion in some cases.

Internal corrosion of water mains was accompanied by the deposition of incrustations of a limpet-like form, the upstream face of the limpet being steeper than the downstream face. They rarely formed to a greater height than 1½ in. in large mains. They were hard without and soft within, and were composed of cancentric layers of ferric oxide, the outer layers being sometimes black magnetic oxide. The iron below the limpets was invariably pitted by corrosion. Whether the electrolytic or the acid theory be correct, the presence of dissolved oxygen in the water was essential before corrosion took place.

The question naturally presented itself whether comparative immunity from attacks could be brought about by the partial removal of the dissolved oxygen from the water. In the case of a 350 mile 30-in. main between Mundaring and Kalgoorlie, Western Australia, such a course was suggested on the occurrence of severe corrosion, but was not put into practice. The idea was to remove the air by spraying in a vacuum.

As might be expected, the corrosion increased with the rapidity of flow of the water; but there appeared to be a critical velocity above which the corrosion ceased to rise, and even diminished again. Sewage contamination appeared to use up the free oxygen, and, provided there was no deleterious acid present, such water did not corrode the pipes to any great extent. Grease also acted as a protective.

Hard waters, such as London water, were only slightly corrosive. The addition of alkaline solutions greatly diminished corrosion. External corrosion of pipes was much increased by the presence of set-water, and contact with ashes and cinders had a deleterious effect, probably due to galvanic action. It was generally agreed that cast-iron resisted corrosion better than steel, and that this was largely due to the siliceous foundry skin affording a certain measure of protection.

The author went on to say experiments showed that, speaking generally, the harder the steel the less liable it was to corrode. Hard steel, however, could not be used for welded pipes. Small percentages of chromium and copper were of value in reducing corrosion; but it was important to specify a low manganese content, as manganese generally indicated the

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[*] Paper and Discussion: Institution of Sanitary Engineers, Westminster, London, Eng.

presence of manganese sulphide, which increased the liability to corrosion.

Nickel a Valuable Adjunct

Nickel was a valuable adjunct in reducing corrosion, but was only really effective in large quantities, which rendered the steel unsuitable for pipes. Provided that phosphorus was limited to ·1 per cent., its presence was rather beneficial than otherwise. Silicon had a marked preventative action; if 20 per cent. was present, the product was practically incorrodible, whilst 3 per cent. had a marked beneficial effect. Unfortunately, such high percentages rendered the metal unsuitable for pipes, owing to its excessive hardness and brittleness. The presence of sulphur was always objectionable, as it not only tended to set up galvanic action, but formed sulphuric acid in addition.

Steel which had been subjected to stress was more liable to corrode than unstressed metal. It was, therefore, important to remove the internal stress by annealing.

In the early days of electric traction considerable damage was brought about by stray currents; but recent Board of Trade regulations afforded quite suffisient protection to water-mains, provided they were kept at least 2 ft. clear of the rails, and that the ground was not impregnated with salt water, in which case it was well to surround the pipes with lime concrete as an additional protection beyond the usual coating mixtures. Abroad, it was well to give the rails a wide berth, unless the regulations affforded protection equivalent to that given by the Board of Trade.

For ordinary cases, it had been found that a coating of Dr. Angus Smith's solution was a fairly-efficient protection against corrosion. The mixture used nowadays consisted essentially of coal-tar and pitch-oil in the proportion of 2 to 1 by bulk, and the pipes were dipped in this at nearly boiling temperature after all rust and scale had been removed. There was a possibility that pinhole penetrations caused by air bubbles would impair the coating, and a second dipping was advisable.

In the case of an important pipe line at Birkenhead, an entire recoating of the inside of the pipes with Siderosthen, an oil-tar mixture, was specified. For outside protection a wrapping of hessian saturated with bitumen was usual. The wrapping on the joints and on places where the hessian had been damaged in transit had to be done in the field.

AN INTERESTING DISCUSSION

In the ensuing discussion, Mr. H. F. Rutter, M. Inst. C.E., said that a year ago he had examined a 30-in. cast-iron main laid in London in 1811, and found it both internally and externally in every respect as good as the day it was laid. The internal surface presented a black appearance, and was perfectly smooth except for a few scattered nodules, in no case more than ¼ in. in height. Thus the co-efficient of friction was practically the same after 104 years' use as when the pipe was first laid. The pipes were, of course, made of cold-blast iron, and were not coated in any way. His experience seemed to show that the resistance to oxidation of cold-blast iron was superior to that of hot-blast iron. A contrasting instance might be quoted of a 21-in. pipe taken out of use owing to alternations a few years ago. This pipe had been used continuously for the conveyance of filtered London water for eighteen years. The whole internal surface was covered with nodular oxidation, averaging, perhaps, ½-in. high, below each nodule there being a complementary pit. There was no evidence as to the material which had been used as a protective coating. Apart altogether from the reduced strength of the pipe due to the severe pitting, the increase in the co-efficient of friction would have been very serious in any considerable length of main. At a very moderate estimate that co-efficient must have been at least four times that of the pipe when new. About a month before the meeting he had occasion to open for examination some 42-in. steel pipes which had been used for fourteen years for the conveyance of raw Thames water through a tunnel beneath the river Thames. The internal surface of those pipes was entirely free from oxidation and perfectly smooth. The whole surface was coated to a depth of about ½ in. with a soft deposit which he took to be clay, the water conveyed containing small proportions of that material in suspension. It was of about the consistency of cream cheese, and could readily be brushed off. Apparently this coating had afforded complete protection against oxidation. He could not venture to give the reason for the clay deposit clinging to the steel pipes while showing no disposition to adhere to the cast-iron pipes forming a part of the same main.

CAST IRON v. STEEL

Mr. E. J. Fox (Messrs. Stewarts & Lloyds, Ltd.) said Mr. Rutter's long experience and use of cast-iron pipes perhaps not unnaturally prejudiced him in their favour; but the instances Mr. Rutter cited in favour of cast-iron pipes to the detriment of steel pipes could scarcely be called convincing. First, Mr. Rutter referred to a cast-iron pipe which had been in use for over a hundred years, and had recently been found in first-class condition. Probably nobody knew better than Mr. Rutter himself that the cast-iron of a hundred years ago was not the cast-iron of to-day, and therefore any comparison between cast-iron and steel pipes should be made between the commercial articles of to-day. Secondly, Mr. Rutter criticized a steel pipe which he had examined, and in which he had found internal incrustation to the depth of about ⅜ in. It was so generally accepted that cast-iron pipes encouraged internal nodular growth to a far greater extent than did steel pipes that the instance cited by Mr. Rutter could only leave the impression that if the pipe to which he referred had been cast-iron instead of steel the internal nodular incrustation would have been far greater. Both cast-iron and steel pipes were subject to corrosion if corrosive influences were present, but it was interesting to note that, while in the case of cast-iron the internal nodular incrustation often grew to a depth of 2 in. to 3 in., in the case of steel it was limited to about 1 in.; and while the depth to which corrosion would penetrate in the case of cast-iron was about ⅜ in., this depth was limited, in the case of steel, to about ⅛ in. The relatively greater proportion of steel pipes used increased yearly, and as long as eight years ago the British Board of Census of Production for 1907 (published in 1909) gave the length of steel pipes bought annually as more than three times the length of cast-iron pipes.

Dr. J. Newton Friend said it was impossible for any sweeping assertions as to the superiority of one class of iron over another from the point of view of corrodibility to be true. Recent research had conclusively proved that there are optimum conditions for each type of metal. Within the last two years Mr. C. W. Marshall and himself had carried out a considerable number of experiments with a typical grey cast-iron and a mild open-hearth steel. The results showed that the cast-iron was far more resistant to alternate wet and dry (i.e., normal weather) conditions than steel. When completely immersed in water or salt solution there was little to choose between the metals, but when exposed to acid-corroding media the cast-iron exhibited a very marked inferiority. If, as he believed, the metals experimented with were truly representative, these results might be taken to apply to ordinary commercial grey cast-iron and mild steel generally. The present-day problem, therefore, resolved itself into the task, not of making sweeping generalizations, but rather of determining which metal was most suitable for any particular purpose. There was every reason why this should be accomplished by extensive experimental research and careful observation, but there was no other method by which the necessary information could be obtained. Furthermore, the problem must be attacked afresh whenever radical changes were made in the methods of producing the metals concerned.

The Exterior Painting of Woods

DURING the last year careful investigation of a considerable number of paint failures, due to excessive cracking, scaling and peeling in a number of cases, developed the information that the condition in a great many instances was due to the improper application of the paint rather than to the character and quality of the material applied.

The vital factor in determining satisfactory paint-wear is **penetration.** Without penetration no paint will afford a protective coating which can successfully withstand temperature changes and other climatic forces.

Penetration obtains that amalgamation within the wood which is essential. It is the force which fixes the "tooth" of the paint in the fibres of the lumber. When the paint dries, the pigment and oxidized oil film, besides forming a closely cemented bond, become a part of the wood itself. The foundation upon which a durable, protective and decorative film can subsequently be applied is procured, and whereas contraction and expansion of the wood will readily cause breaks in a paint coat not thoroughly united to it, where the proper depth of penetration has been obtained the paint coat will hold fast, and depending on its elasticity, will yield with the strain placed upon it.

Penetration, which is so essential, is obtained in the application of the **priming coat.** This coat very frequently receives the least attention, and yet upon it, in a large measure, depends the serviceability of the completed coating.

While dealing with the subject of the priming coat, it is advisable to refer to a common, and at the same time a much-abused, practice.

Most paint shops keep containers, into which are slipped the remnants of paints and various odds and ends. Usually one receptacle is kept for the whites and tints and another for dark-colored paints. These accumulations are used from time to time for priming-coat work. In standing around the mixture becomes contaminated with foreign material; it skins over many times; the oil becomes fatty; and altogether it forms inferior material for the priming coat.

The economy evidenced is commendable, but materials of this kind cannot be too strongly advised against for priming-coat work of any consequence, such as dwellings, public buildings, etc. It is very impractical because of the disastrous results which follow. There are many other places where this accumulation can be used to good advantage.

To-day the proper application of paint confronts one with a larger line of problems than ever before. Among these none is of so much importance as the question of lumber.

It is frequently stated that paint does not wear as well to-day as it did years ago. This is true in some sections, but it has been demonstrated over and over again that it is not the fault of the paint. The disintegration noted points unmistakably to the fact that the character and quality of the lumber must be held accountable.

There are many to-day who keep on applying an all-oil priming coat, or, at the best, a primer containing very little turpentine, over a hard, resinous or sappy wood, and marvel why the best results they obtain are not as good as those produced by their forefathers.

The material applied is fully as good, and in the majority of cases is of improved quality, and the method of application is as careful and complete, but the surface over which the paint is applied is vastly different. The soft pine lumber, which was dry, porous and readily absorbed the oil primer, differs very markedly from the lumber commonly used to-day.

At no time has a tree growing in the forest been transferred to the side of a building in so short a time, and this without the opportunity to make of the wood a proper surface over which to paint. Twenty-five years ago the tree was cut down and was floated down a stream for many miles, during which time it became thoroughly water-soaked. The sap and resin were broken away from the moorings they held originally, and when the tree was cut into pieces and allowed to season, the water in coming out not only carried along a considerable portion of the resin and sap, but so thoroughly broke up the method of their arrangement that by the time the paint was applied good penetration of an oil paint was possible. This was especially true because the lumber had sufficient time to become dry and the resin to harden, thereby losing a part of its obstructive nature through the volatilization of the sap.

In applying an oil priming coat over a hard, resinous, sappy, or greasy lumber, the penetration obtained is very slight at the best. In order partly to obtain conditions resembling those present in good quality white pine, it is advisable to allow the surface to remain unpainted for several months, thus permitting it to go through a process of weathering.

Where it is necessary immediately to apply the priming coat, the paint must be reduced with turpentine, so as to obtain the same depth of penetration today that years ago resulted from an all-oil or nearly all-oil reduced primer applied over soft pine.

It has been shown repeatedly that paints giving good results on soft pine show the opposite condition on hard pine, where the application is the same in both instances. The deterioration in the second class in almost every instance is found to be directly over resinous grains in the wood, indicating lack of penetration. To correct for this, a liberal reduction of the paint with turpentine for the priming coat yields excellent results.

Some woods are so constructed that even this treatment will not obtain the desired effect. Solvents, such as benzol, have been resorted to, and in some instances the results obtained have proved satisfactory. Leading painters who have tried it out are recommending its use. The writer's experience has led to the conclusion that while a solvent like benzol is applicable for a certain kind of lumber, it is no better than, and at times not as good as, turpentine for other types.

Concerning the use of benzol, it is well to insert the caution that it should be used only for priming-coat work. Because of its strong solvent properties when used in succeeding coats, it acts like a paint remover.

Benzol and asphaltum distillates are not generally recommended, because the proper materials are not readily obtainable. If the correct distallates are not used, unsatisfactory results are likely to follow. The contractor should carefully consider, and so far as he deems it advisable to be guided by, the directions of the manufacturer of the paint. These directions generally recommend different reductions for different kinds of wood and for different coats.

The reduction of paint for the second coat should closely resemble that used for the priming coat to assist in obtaining the proper penetration, and also in preparation of a surface over which is applied the finish coat, which should contain only enough turpentine to give good working, and, with the japan, assist in obtaining the desired drying. The use of only a small amount of turpentine in the finish coat will ensure a full oil-gloss finish.

One of the first new buildings in New York City to have a portion of its roof arranged as a recreation space for the free use of the tenants is that in course of construction on the northeast corner of Broadway and Twenty-sixth Street. Half of the roof is devoted to a room connected with the roof proper by doors, so that the entire area will be a convenient and well-equipped recreation space for the workers in the building.

The longevity of cast iron pipe when used for plumbing fixtures has been demonstrated in the destruction of the old Astor House, New York City, tomake way for the new Broadway subway. The Astor House was erected in 1834 and the soil pipe is still practically as good as new.

In tearing down the Champlain Building, Chicago, the structural steel and other heavy wreckage is handled by a stiff-leg derrick mounted on the roof of an adjacent taller building. The new structure will form an extension of this building, and the derrick will be used in its erection.

A contract has been made by a utility company with the Local Government Board for Scotland to build about 8,000 houses on the Admiralty land at Rosyth at an approximate cost of a million pounds sterling, the equivalent with foreign exchange at par being $4,866,500.

A Dictionary of Building Trade Terms

THE following definitions will not be found in any of the standard dictionaries, but many of them will be understood and appreciated by those who have been identified with building operations. They were compiled by W. Livingstone Larned, and published in The Building Age, of Chicago—a city the inconsistencies of whose building trades are too well known to mention. Of course the definitions could not apply to the Canadian trades without great modifications.

Architect.—A man who never puts closets and windows where you want them; a gentleman of some importance—at one time "a person skilled in the art of building."

Attic.—That part of house which is never quite completed.

Bills.—Insistent reminders which never stop coming.

Brick.—Little pieces of red earth, in convenient shape to break when dumped from wagon.

Carpenter.—A gentleman of uncouth appearance who stains neat, white pine planks with tobacco juice, who is always stopping to eat his lunch, and who "strikes" just before the roof is put on.

Chimney.—An arrangement for drawing smoke down and into rooms.

Chisel.—An excuse for a grindstone.

Contractor.—One who contracts; generally a hard-working man of limited means who is handicapped in life by the reputation of possessing shrewd cunning and great wealth; a buffer between an architect and his client; sometimes known as a "boacontractor."

Door.—Big piece of wood opening the wrong way.

Extras.—What the building is really made of.

Hammer.—An instrument of torture used extensively for purpose of crushing fingers.

Hardware.—House jewelry.

Keys.—Little jiggers a locksmith is compelled to bring in a hurry because the originals were lost.

Kitchen.—A place where the bone of contention is cooked.

Knotholes.—What they send instead of timber.

Laborer.—One who stands back and silently admires what somebody else has done.

Laths.—Equivalent to bones in a Shad. Long, slender planks, which permit expensive plaster to ooze through and out of sight.

Lime.—What a plasterer puts on his face.

Masonry.—Expensive stuff upon which to rest the house; outer "skin" of the cellar; dam used to hold water in basement when it rains.

Mortar.—Long box of damp, soggy material mixed up for benefit of children in vicinity—that which a mason squeezes out from between the bricks after he has taken the trouble to put it there.

Nails.—Little pieces of wire, or steel, chopped into conveniently short lengths for baby to bite on. Used extensively by carpenters to sprinkle over the ground.

"Nearing Completion."—The situation from the time the job is started until you decide to sell the place.

Night-watchman.—Sound sleeper; a human machine for speedily removing all fire wood and wood blocks.

Painter.—An artisan who suggests that green is a good color for shutters.

Pergola.—Where the contractor makes his velvet.

Plans.—Diagrams of the way you do **not** want the house.

Plaster.—An ingredient employed as a flood-dressing.

Plumber.—An impostor who tears down and rips out everything as soon as it is completed. (See Brigand.)

Putty.—Carpenter's dough. An article found one year later, in wasteful wads, beneath the back porch chairs.

Roof.—The one part of a house upon which no two people agree.

Sash.—Bandages for holes in side of house.

Sash Cord.—Wash lines at double the price.

Sash Weight.—Inside decoration.

Saw.—An instrument with teeth, used to cut the right timber into the wrong lengths.

Sawdust.—Practically all of a two-by-four, except a half dozen knot-holes.

Saw-horse.—A convenient place for workmen to sit.

Shingles.—Flat surfaces of nice smooth boards cut thin. When sliced,, used by neighbors as kindling wood.

Staircase.—Device for mussing up proper arrangements of rooms.

Trees.—Leafy, green ornaments which must invariably be cut down on your property before building, no matter where they are.

Trowel.—Irish tablespoon.

Varnish.—Preparation for covering up defects.

Wainscoting.—The space used by painters for practising.

Water Boy.—A small chap, carrying a bucket half filled with saw-dust and water, who is always on hand when you are **not** thirsty.

Wife.—A female person who changes her ideas every time she sees the plans.

A Noteworthy Engineering Tour through Canada

An invitation is being sent to members of the National Engineering Societies of America and others attending the Engineering Congress in San Francisco next month to return through Canada and view the interesting engineering works within convenient distance of the main lines of transportation through the provinces of British Columbia and Alberta. In this connection a general circular has been prepared for the membership of the American Societies of Civil, Mining, Mechanical, Electrical, and Marine Engineers. Special arrangements have been made with the railway companies for train and steamer facilities from San Francisco, via Victoria and Vancouver, B. C., and Calgary, to Chicago. This will afford an ideal opportunity to take the magnificent scenic trip through the Canadian Rockies and visit many important structural undertakings. The rates charged are of sufficient interest to call for special mention. Round trip tickets from any point in the east may be secured covering the return through the Canadian North-West via the Canadian Pacific on the regular rates to San Francisco and return, plus $17.50 for the routing by way of Portland, Seattle, and Vancouver. As an instance, a round trip ticket from New York for the entire trip would be $98.80 plus $17.50. At the request of the Canadian Committees, Mr. C. W. Allen, Engineer of the Dominion Water Power Plant, in charge of the water power exhibit in the Canadian Pavilion at the Panama-Pacific Exhibition, has arranged to make the final preparations for the trip.

Mainly Constructional

East and West—From Coast to Coast

The George Frid Brick Company, Limited, Hamilton, has been incorporated with a capital of $40,000. J. E. Frid and J. A. Forrest are among the Directors.

The Collingwood Shipbuilding Company is refitting a portion of its plant in order to take care of a large order for 25,000 shells and high explosive shells.

The Ritchie Construction Company, Limited, with head office at Beamsville, Ont., is a new contracting firm organized with a capital of $100,000. The incorporators include John Ritchie and H. S. Lloyd, both of Beamsville.

Fred. G. Roberts & Company, Limited, Toronto, has been organized with a capital of $40,000 to take over the contracting business of Fred. G. Roberts & Company. The Directors include F. G. Roberts and T. H. Barton.

The Central Technical School at Toronto, which was built and equipped at a cost of two million dollars, was officially opened on the evening of Tuesday, August 31st, by Sir John Hendrie, the Lieutenant-Governor of Ontario.

The Ideal Incinerator and Contracting Company, Limited, Toronto, has been reorganized with a capital stock of $250,000 and the following Directors—all Toronto men:—G. E. Farley, A. E. McFaul, R. T. Shillinglaw, F. H. Pratt, and N. Phillips.

The Quebec Munitions Company, Limited, Montreal, has been incorporated with a capital of $50,000 to carry on the manufacture of all kinds of war munitions. The incorporators include Howard Murray, C. N. Monsarrat, and V. I. Smart—all of Montreal.

In British Columbia work is in progress on an extension of the Pacific Great Eastern Railway estimated to cost three million dollars. The office of the railway is at 325 Howe Street, Vancouver, and the Chief Engineer is Mr. John Callaghan. The general contractor is Mr. P. Welsh.

An interesting job upon which tenders are now being received is the new office and warehouse at Regina for the Robert Simpson Company, the proprietors of the well-known departmental store, Toronto. The new building, which is to be of concrete, brick and steel construction, is to cost $150,000.

Mr. J. D. McArthur, the well-known Winnipeg contractor, who has the contract for the construction of the Hudson Bay Railway, states that the line will be completed next season. The delay in construction has been due to the building of two very heavy bridges across the Nelson River.

Mr. Charles D. McArthur, who since April, 1914, has been Chief Engineer for Foley Brothers, Welch, Stewart & Faquier, has again assumed the office of Chief Engineer of the Blaw Steel Construction Company, of Pittsburgh, and will be in personal charge of its engineering service department.

Mr. John E. Belcher, a well-known civil engineer of Peterborough, Ont., died last week in that city. A native of Cork, Ireland, he went to Peterborough early in life, and was engaged in the active practice of his profession until quite recently. For many years he was City and County Engineer.

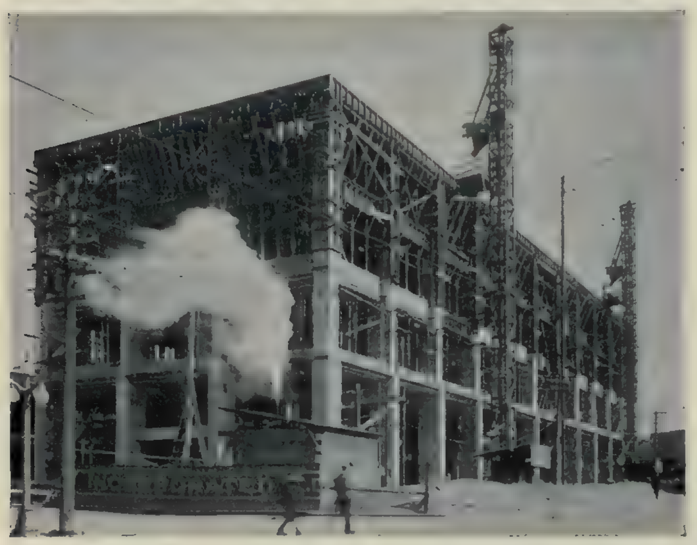
Action has been taken against the city of Verdun, Que., in connection with a street paving contract. The plaintiff is a rate-payer named Barrette, who has succeeded in obtaining a writ of injunction preventing the city from giving a $73,000 paving contract to the Warner-Quinlan Company.

It is alleged that lower tenders were submitted by other contractors, and that a saving of nearly $12,000 could have been effected had these been considered. Further, it is stated that the city did not specify the kind of material to be used, or the quantity needed.

Because the majority of the workmen were found to be foreigners, and not residents of the city, and because of other alleged breaches of the agreement with the city, the Board of Works of Berlin, Ont., have ordered the Warren Bituminous Company to stop work on the Heins Avenue pavement.

According to an Ottawa despatch the basis of an agreement between the Government and the Toronto Terminal Company has been reached. By the agreement the Government agrees to bear the cost of the construction of the eastern wing of the new Union Station building. This wing will comprise the Government offices and the Post Office.

The Toronto Structural Steel Works have completed arrangements for the manufacture of shells at Mount Dennis, Ont. A large number of extra employees were taken on last week. No. 3 building of the Kodak Company is finished, and No. 5 is rapidly nearing completion. These are only two out of nine large new buildings which this company is erecting.


The Hudson Bay Company's new block at Victoria, B. C.

The growing importance of Canada in the eyes of the Empire is indicated in the fact that Canadian manufacturers are being invited to tender for large supplies of materials required for the equipment of the North-Western Railway of India. Copies of the forms of tender, etc., have been received by the Government. Thousands of brass and steel boiler tubes are called for.

At the annual meeting of the Saskatchewan Coal, Brick & Power Company, Limited, held recently at Weyburn, it was estimated that the town's property contained four million tons of coal, and that fifty thousand common brick could be manufactured daily. The officers of the company said that as soon as capital was available the operations could be extended to include the manufacture of brick, sewer pipe, drain tile, and pottery.

An arrangement has been effected between the Canadian Locomotive Company, of Kingston, Ont., and the Baldwin Locomotive Company, of Philadelphia, whereby the Ontario plant will secure the manufacture of all trucks used in Canada, formerly made by the Philadelphia concern. The trucks are used mostly on high-speed suburban cars of the electric type. At present the company is filling an order for the Lake Erie and Huron Hydro-Electric Railway.

The Chilliwack sewerage system, which has been under construction for sixteen months, has now been completed. Considerable difficulties in the way of water and quicksand were encountered in the course of the work. The trouble with the water was overcome by the aid of large pumps, but the quicksand proved such a problem for the contractors that they failed to complete the work, and the contract had to be turned over to the city. Mr. R. A. Henderson is the Town Engineer of Chilliwack.

The Ross Rifle Company of Quebec has set a commendable example in connection with engaging additional employees. The Ross Company will soon require an additional five hundred or six hundred men, as the balance of their new machinery order is expected in the course of four or five weeks. The Militia authorities in Ottawa have been notified, and have been requested to furnish the Ross Rifle Company with names of returning soldiers, so that these may be given preference in taking on the new men required.

The Railway Commission appointed to investigate the charges made in regard to Manitoba's new Parliament Buildings have issued their report. The charges are found to be substantially true, and there is said to have been fraud and much overpayment since the contract was let to Thomas Kelly & Sons over three years ago. The overpayments amounted to $822,963. Unfavourable inferences are made from the actions of G. D. Coldwell, J. H. Howden, Thomas Kelly, V. T. Horwood, Dr. R. M. Simpson, W. A. Elliott, M. G. Hook, and Harry Whitla, K.C.

Baltimore advices state that the C. D. Prudden Company, of that city, is figuring on a $3,000,000 contract for portable houses which the French Government is planning to buy in order to provide homes for people whose homes have been destroyed. The firm is said to have been shipping a large number of aeroplane hangers for the Russian army and portable garages for the British army in the last seven months. The portable garages and hangers which the Baltimore firm has been supplying, and the houses and portable field hospitals on which it is at present figuring, are made of galvanized open-hearth steel and are in sections, two feet wide and from 8 to 10 feet high. Each section fits into the other one, so that no rivets, screws or nails are necessary for their erection.

The Boving Hydraulic and Engineering Company, Limited, with head office and works at Lindsay, Ont., has been incorporated for the purpose of continuing the business of Boving & Company of Canada, Limited, and has acquired the complete undertaking of that firm. The General Manager is Mr. E. A. Jacobson, who has been connected with the Boving Companies in this country as Chief Engineer for the last five years. The removal of the head office and works to Lindsay, together with other changes that have been made, will greatly increase the efficiency and reduce expense, with the result that the firm is now in an excellent position to quote attractive prices and make prompt deliveries.

At a meeting of the Maritime Board of Trade held recently at Charlottetown, P. E. I., a resolution was passed urging the Dominion Government to take such steps as would develop the stone quarrying industry in the Maritimes. Mr. R. G. Hood, of Quarryville, N. B., President and Manager of the Miramichi Quarry Company, Limited, addressing the meeting, discussed the splendid qualities of the sandstone of the Maritime Provinces. He deplored the fact that many public buildings in Canada were constructed of American stone when better material could be purchased at home. The Dominion Government specified that only Canadian stone should be used in the erection of their buildings, but the quantity required for these was comparatively small. Mr. Hood urged that the stone-quarrying industries were entitled to adequate protection.

Contracts are being called by the Quebec Streams Commission for the construction of a dam on the St. Francis River, P. Q., for the storage of water from a drainage area of 472 square miles, with a view of increasing the water power on the river during low water periods. It will supply 6,000 horse power years to the powers now developed on the river, including powers at D'Israeli, Weedon, East Angus, Windsor Mills and Drummondville. It is calculated that the low water flow will be increased by 500 cubic feet per second. The dam is to be located at the outlet of Lake St. Francis, in the townships of Coleraine and Price, six miles above the town of D'Israeli. The scheme includes the expropriation of numerous farm and wooded areas in the townships of Lambton, Price and Winslow, the total estimated cost, including the dam, being $400,000. The dam will be of the hollow concrete type, consisting of a series of buttresses, five feet wide, and 20 feet centre to centre, supporting an arched apron or deck. The water will be raised 27 ft. above low water level of the lake; the capacity of the reservoir thus created is figured at 438 square mile feet. The dam is to be provided with a log slide and three bottom sluice gates, and 90 feet of spillway from elevation 117. Power companies interested have for some time urged the advisability of the construction of a dam, in order to increase the flow of water. The plans were drawn up under the direction of Mr. O. Lefebvre, the chief engineer of the Commission.

At a simple but impressive ceremony the Premier of British Columbia, Sir Richard McBride, recently opened the Marine Drive, constructed at a cost of about $300,000, and one of the finest drives on the Pacific Coast. Mr. G. Hay, Reeve of West Vancouver, presided at the official opening. The Premier stated that within ten years he expected to see the Marine Drive connected with the head of Howe Sound and Squamish. The two new bridges which span the Capilano River, as well as one in the district of North Vancouver, are excellent examples of skill in design and workmanship. The Capilano bridges, which are constructed of reinforced concrete, were built by Naylor Brothers at a cost of about $48,000. The larger structure is 335 feet long, with approaches of 480 feet. When completed, the new Marine Drive will be some thirty miles long.

The city of Vancouver is being sued by the Union Contracting Company for $34,585 damages. The contracting company was awarded contracts for the four east end viaducts, and commenced operations on the Hastings street viaduct, the largest of the four. By the time this was completed the City Council had decided to postpone the building of the other three. In outlining the case for the Union Contracting Company last week, Mr. S. S. Taylor, K.C., said his clients had brought machinery and equipment enough for the four viaducts. They had also been put to a loss through being unable to use the false work of the viaduct over again, and the tall wooden tower for pouring concrete, erected half way between the Hastings and Pender street viaduct sites, had been a partial loss because the Pender street viaduct was not gone on with. The case is proceeding.

It would appear that Manitoba was at last entering upon a new era of administration if one may judge by a scene which took place at Winnipeg in the office of the Minister of Public Works last week when tenders on two Government contracts were opened and awarded in public. Newspaper advertisements had announced that the Hon. T. H. Johnson would open tenders for the construction of a tunnel from the power house to the new court house, and that tenderers and anyone else who chose could be present. Accordingly, at 12 o'clock, the Minister's office was crowded. Before opening the tenders, Mr. Johnson said that one tender had been opened by mistake, because nothing on the envelope indicated that it was a tender. However, it had not been looked at. Also, another tender had come in twenty-four hours late. The tenderer had explained that he had mistaken the time. However, Mr. Johnson said he had no right to consider this tender if any other contractors objected. In order to see if any objections were forthcoming, ballots were handed round. Two were returned to the Minister with the word, "object. He therefore did not open the tender, and it lies in the office of the department waiting to be reclaimed. Mr. Johnson announced that the lowest tender would be recommended for acceptance.

The Osgood "18" Steam Shovel

A circular received from The Osgood Company, Marion, Ohio, is devoted to a description of the firm's Osgood "18" ¾ yard Revolving Steam Shovel. This fine piece of contractor's equipment is mounted on traction or railroad wheels, and its shipping weight is 17½ tons. It is designed and built so that a clamshell outfit can be readily attached to any shovel in the field. The shovel has an independent steam steering engine, also a hand steering apparatus operated from either side. The boom is 17 feet long and the handle 11 feet, which gives a 13-ft. dump with the boom pitched at 55 degrees. This shovel can easily be equipped with a boom raising and lowering device which is especially popular in sewer contract work, enabling the operator to dig 15 feet deep. The Osgood Company specialize in modern excavating machinery. Their products comprise standard steam shovels, revolving steam shovels, traction steam shovels, electric and gasoline shovels, railroad ditchers, deep water dredges, ditching dredges, unloading plows, etc.

The Osgood "18" Steam Shovel.

Mr. Louis C. Fritch, Assistant to the President of the Canadian Northern Railway at Toronto, has been appointed General Manager of the lines east of Port Arthur in addition to his present duties. Mr. Fritch received his engineering education at the University of Cincinnati and entered railway work in 1884 as supervisor's assistant on the Ohio & Mississippi. In 1886 he was appointed Assistant Engineer and served in that capacity until 1892 when he was appointed Engineer Maintenance-of-way. In 1893 he became a division engineer on the Baltimore & Ohio Southwestern and in 1889 was appointed Superintendent of the Mississippi division of that road. He went to the Illinois Central in 1904 and became assistant to its General Manager in 1905. He was appointed assistant to the president in 1906 and consulting engineer in 1909. Later he was appointed chief engineer of the Chicago Great Western. He was appointed assistant to the president of the Canadian Northern in 1914.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Berlin, Ont.
Tenders on the construction of sewerage disposal works will be received until September 7th by the City Clerk, A. H. Miller. Work will include tanks, filters, sludge beds and pumping station. Plans and specifications at offices of the City Engineer, H. Johnston, and of the Consulting Engineers, Chipman & Power, 204 Mail Building, Toronto.

The plans for extensions to the sewage disposal plant have been approved by the Provincial Board of Health. Estimated cost of work, $75,000. Engineer, Herbert Johnston.

Blandford Township, Ont.
Tenders on the construction of a tile drain will be received until September 11th by the Township Clerk, George Oliver, Bright. Plans and specifications at offices of the Clerk and the Engineer, J. F. Ure, County Buildings, Woodstock.

Brantford, Ont.
The City Council are considering the construction of concrete curbs on a number of streets, at an approximate cost of $2,760. Clerk, H. F. Conant.

Brantford Township, Ont.
A by-law has been passed, providing for the construction of concrete sidewalks on a number of streets. Township Clerk, J. A. Smith, Court House, Brantford.

Cochrane, Ont.
The Town Council will shortly call for tenders on extensions to the water and sewerage systems. Quantities of pipe and tile will be required. Clerk, H. J. Brown.

Dartmouth, N.S.
The Town Council contemplate laying concrete pavements on Wentworth, Ochterloney and King Streets. Clerk, A. Elliott.

East Farnham, Que.
Tenders will be received until noon, September 7th, by the Municipal Secretary, M. Stevens, for gravelling the main road through the Municipality. Plans and specifications at office of the Secretary.

Ekfrid Township, Ont.
Tenders will be received until September 28th by G. J. Stevenson, R. R. No. 4, Appin, Ont., for the construction of a tile drain and clearing a quantity of open drain.

Fort Frances, Ont.
The Town Council contemplate laying sewers on Sinclair and Victoria Streets and on Armit Avenue. Clerk, J. W. Walker.

Guelph, Ont.
Work is about to start by day labor on the construction of concrete sidewalks on Alma, Lucan, Richardson and Margaret Streets, under supervision of the City Engineer, J. C. McArthur.

Listowel, Ont.
The by-law providing for the construction of a waterworks system has been carried, and tenders will be called shortly. Town Clerk, W. Bright. Approximate cost, $5,400.

New Westminster, B. C.
The City Council contemplate replacing the watermain which feeds the upper reservoirs on account of its leaking condition. The new main will probably be of 14-inch diameter. Estimated cost, $15,000. Engineer, J. W. Blackman.

Norfolk County, Ont.
The County Clerk, E. H. Boughner, Simcoe, will receive tenders until 10 a.m., September 7th, for the construction of a retaining wall on the Town Line, Houghton and South Walsingham. Plans and specifications at the residence of J. T. Simmons, Courtland.

Owen Sound, Ont.
The Town Council are considering the construction of sewers on Eighth and Fourth Avenues. Clerk, Charles Gordon.

Sherbrooke, Que.
The City Council are considering the construction of sewers and concrete sidewalks on a number of streets. Clerk, E. C. Gatien.

Stamford Township, Ont.
The construction of a concrete sidewalk on Glenholme Avenue is being considered by the Township Council. Clerk, C. F. Munroe, Southend.

St. Hyacinthe, Que.
A by-law will be submitted to the ratepayers on September 16th providing for the construction of gravity filters and the installation of two pumps, motor, boilers, pipe connections, valves, etc., estimated to cost $75,000. City Clerk, A. Messier.

St. John, N.B.
Commissioner Potts has recommended the construction of retaining walls on Main, Moore and Rockland Streets, at an approximate cost of $16,300. City Clerk, H. E. Wardroper.

Thetford Mines, Que.
Work has been commenced by day labor on the construction of a waterworks system, estimated to cost $12,000. Material is being purchased by J. L. Demers, Notre Dame Street, Thetford Mines.

Toronto, Ont.
Tenders on the construction of sewers on Cairns Avenue and on Golfview, Ivy, Lambert, Lyall and Rockwell Streets will be received until September 14th by the Board of Control. Specifications at office of the Works Department.

Welland, Ont.
Work will start shortly on the construction of sewers on Seeley and Merritt Streets. Engineer, D. T. Black.

Windsor, Ont.
Extensions to the watermains are being considered by the City Council. Clerk, S. Lusted.

CONTRACTS AWARDED

Ford City, Ont.
A contract for laying concrete sidewalk on Drouillard Road has been let by the Town Council to the Chick Contracting Company, McDougall Street, Windsor, at 9c. per square foot.

Lennoxville, Que.
A water system is being installed at Bishops College by the Eastern Pipe & Construction Company, Limited, 128 St. Peter Street, Montreal. Manager, J. A. Bambrick.

Maryborough Township, Ont.
The general contract for the construction of a drain has been let by the Township Council to Crowley & Son, Gads Hill.

Montreal, Que.
The contract for the supply of granite paving blocks has been awarded by the City Council to the Stinson-Reeb Builders' Supply Company, 45 St. Alexander Street, 488,000 blocks at $69.90 per thousand, and to W. McNally & Company, 50 McGill Street, for the supply of 271,350 scoria blocks at $49.85 per thousand.

The City Council have let the contract for the supply of Bessemer Artificial Blocks to the Stinson-Reeb Builders' Supply Company, 45 St. Alexander St., at $41.25 per thousand. Quantity to be supplied, 1,464,930.

Niagara Falls, Ont.
A contract for the construction of sewers has been let by the City Council to L. Sacco, 69 Ferry Street, Niagara Falls.

Ottawa, Ont.
The City Council have let the contract for laying pavement on a portion of Gilmour Street to the Union Construction Company, Bank Street Chambers, as well as the contract for laying tarvia pavement on the same street. Approximate total cost, $25,000.

The contract for laying asphalt and sandstone block pavement on Preston Street has been awarded by the City Council to the Ottawa Construction Company, Central Chambers. Estimated cost, $120,000.

South Vancouver, B.C.
Contracts for the supply of sewer pipe have been let by the City Council to the following firms:—McNeil, Welch & Wilson, 80 Pender Street E., 8-inch and 10-inch pipe at $9,010; Evans, Colman & Evans, 207 Hastings Street W., 12-inch, 16-inch and 18-inch pipe at $21,625.

Sudbury, Ont.
The City Council have let the contract for the construction of concrete sidewalks to P. O'Donnel, Regent Street.

Tilbury East Township, Ont.
The contract for dredging the Dau-

phin Drain and for a quantity of road grading has been let to John J. Bechill, 39 Langlois Avenue, Windsor, at $7,957.

Windsor, Ont.
The contract for laying block pavement on Erie Street has been let by the City Council to the Chick Contracting Company, McDougall Street, at $8,564.

Wingham, Ont.
The Town Council have let the contract for laying watermains on Minnie Street to W. Guest, Wingham.

Winnipeg, Man.
A contract for laying creosoted wood block pavement has been let by the City Council to the Kettle River Quarries Company, Limited, Minneapolis, U.S.A., at $2.19 per square yard.

Railroads, Bridges and Wharves

Headingly, Man.
Tenders on the construction of a bridge over the Assiniboine River will be received until September 3rd by Frank Ness, Kirkfield Park, Clerk to the Municipality of Assiniboia. The bridge will be so constructed that the decking may be removed in winter. Engineer, J. W. Rodgers, Municipal Hall, Assiniboia.

Nova Scotia Province
Tenders on the construction of a number of bridges and culverts in Digby and Hants Counties will be received until September 4th by E. H. Armstrong, Minister of Public Works, Halifax. Plans and specifications at the Department, Halifax.

Tenders on the construction of 171 bridges and culverts in Victoria County will be received until noon, September 4th, by E. H. Armstrong, Minister of Public Works, Halifax. Plans and specifications with J. G. Morrison, Englishtown; M. J. Askil, Little Narrows; A. K. McKenzie, Nyanza; J. D. McNeil, Iona; Malcolm McLean, Big Bras d'Or, and at the Department.

Stanfold Township, Que.
Tenders on the erection of a bridge will be received until September 4th by the Municipal Secretary, B. Feeney, Princeville, Que. Concrete and steel construction, reinforced concrete slab flooring.

Wotton, Que.
Work is about to start on the erection of a concrete and steel bridge for the Municipal Council, estimated to cost $8,000.

CONTRACTS AWARDED

Bruce Township, Ont.
Work is about to start on the erection of a bridge for the Township Council. The contract for steel work has been let to the Hunter Bridge & Boiler Company, Queen Street, Kincardine, and for cement work to James McKinnon, East Bruce, Walkerton, Ont. Approximate cost, $3,200.

Lorne Township, Man.
The Township Council have let the contract for the erection of three steel bridges to the Brown Construction Company, Portage Avenue, Winnipeg, at $2,979.

Lunenburg County, N.S.
The contract for the construction of concrete culverts throughout the County has been awarded by the Department of Highways and Mines, Halifax, to Arthur Hood, Shelbourne. Estimated cost, $5,000.

St. Cyprien, Que.
The sub-contract for steel work in connection with the bridge now in course of erection has been let by the Municipal Council to W. H. Wardwell, 10 Cathcart Street, Montreal.

Thamesford, Ont.
The Township Council of East Nissouri have let the contract for the erection of a concrete bridge to William Crellin, Kintore, Ont. Estimated cost, $3,200.

Waterloo, Ont.
The general contract for the construction of a concrete and steel bridge over the Yamaska River has been let by the Town Council to C. J. Dryden & Company, Room 15, 1215 Greene Avenue, Westmount, Que. Approximate cost, $4,000.

Public Buildings, Churches and Schools

Creelman, Sask.
The Trustees of School District No. 998 have been authorized to borrow $5,500 for the erection and equipment of a two-roomed school. Secretary, S. R. Carrothers.

East Cedar, B. C.
Tenders for the erection of a school will be received until September 7th by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of J. Mahoney, Government Agent, Vancouver, J. Kirkup, Government Agent, Nanaimo, Mrs. M. Greenway, Secretary to the School Board, Cedar Post Office, and at the Department.

East End, Sask.
Power to borrow $5,500 for the erection and equipment of a four-roomed brick veneer school has been granted to the Trustees of School District No. 3430. Treasurer, A. J. de L. Clark, East End.

Fort Frances, Ont.
Tenders on the erection of a school and teacher's residence at Manitou Rapids will be received until September 15th by Duncan C. Scott, Deputy Superintendent General, Department of Indian Affairs, Ottawa. Plans and specifications with the Indian Agents, Fort Frances, Port Arthur and Winnipeg, and at the Department.

Lambton Mills, Ont.
Sub-tenders for all trades required in the erection of the proposed school for Section No. 3, Etobicoke Township are being received by the Sutherland Construction Company, Ryrie Building, Toronto.

Manitoulin Island, Ont.
Tenders on the erection of a school and teacher's residence will be received until noon, September 15th, by Duncan C. Scott, Deputy Minister of Indian Affairs, Ottawa. Plans and specifications at office of the Indian Agent, Manitowaning, the Post Offices, Gore Bay, Sudbury, Owen Sound and Collingwood, and at the Department, Ottawa.

Marieville, Que.
Tenders on the erection of a school will be received until 7 p.m., September 15th, by the Secretary to the Board, Dr. Primeau. Plans and specifications at office of the Architects, Viau & Venne, 76 St. Gabriel Street, Montreal. Approximate cost, $35,000.

Romney Township, Ont.
B. Blonde, 14 Cornhill Street, Chatham, is receiving prices on a hot air furnace and hollow tile for roofing in connection with the school which he is building in Section No. 6, Romney.

Rosser Township, Man.
A by-law to provide $11,000 for the erection of a school in Brooklands School Section will shortly be submitted by the Township Council. Secretary, W. H. Beachell, Rosser.

Toronto, Ont.
Tenders on the installation of plumbing and lavatory fixtures at St. Lawrence Market will be received until September 14th by the Board of Control. Plans at office of the Property Department.

CONTRACTS AWARDED

Ailsa Craig, Ont.
The contract for improvements to the school has been let by the Town Council to William Hodgson. Approximate cost, $3,000.

Aldborough Township, Ont.
The general contract for the erection of an exhibition building for the Aldborough Agricultural Society has been let to E. G. Lusty, West Lorne, Ont. Frame construction, shingle roofing. Approximate cost, $4,000.

Aneroid, Sask.
In connection with the school now in course of erection, the contract for masonry, carpentry, iron work, steel, roofing and painting has been let to the general contractor, F. Rooney, Third Avenue, Weyburn, and for heating to G. T. Walker, Weyburn.

Bracebridge, Ont.
The Department of Public Works, Ottawa, have let the contract for the installation of fittings at the Customs Office to the Berlin Office Fixture Company, 34 Lancaster Street W., Berlin.

Clinton, Ont.
Work is progressing on the erection of an addition to the Library for the Staveley Library Trust. The contract for brickwork has been let to Prior & Sweet, the woodwork contract to F. McKenzie, the contract for metal work to Bryan & Sutter, and for cement work to Hill & Cantelon.

Collingwood, Ont.
The Berlin Interior Hardwood Company, 72 Wilmot Street, Berlin, have been awarded the contract for the installation of interior fittings at the Post Office for the Department of Public Works, Ottawa. Cost, $5,000.

East Sandwich Township, Ont.
The general contract for the erection of a school has been let to Joseph Bondy, 115 Parent Avenue, Windsor. Approximate cost, $3,500.

Edwards, Ont.
The general contract for the erection of a school has been let by the Public School Board to F. Cooper, Edwards. Approximate cost, $3,500.

Gimli, Man.
The contract for heating at the school now in course of erection has been let to G. Goodman, Toronto and Notre Dame Streets, Winnipeg, and for elec-

(Continued on page 51)

Tenders and For Sale Department

Bridge Tenders

Sealed tenders for the construction of nine small bridges (steel and reinforced concrete) in the Township of East Whitby, will be received by Wm. Purves, Esq., Township Clerk, Columbus, Ont., up to noon on **Monday, September 13.** For plans and other information apply after September 3 to

BOWMAN & CONNOR,
35 31 Queen St. W., Toronto.

Bridge Tenders

Sealed alternative tenders for the construction of a steel bridge with concrete abutments or a concrete arch truss of 74 ft. span near Keswick in the Township of N. Gwillimbury, will be received by the undersigned up to 6 p.m. on **Tuesday, September 7.** For plans and other information apply to

C. W. WILLOUGHBY, Reeve,
Keswick, Ont.
BOWMAN & CONNOR,
35 31 Queen St. W., Toronto.

THE QUEBEC STREAMS COMMISSION

Proposed Storage Dam on the St. Francis River

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tenders for Storage Dam at the outlet of Lake St. Francis," will be received at the Office of The Quebec Streams Commission, Room 264, Parliament Buildings, Quebec, until Twelve o'clock on **Tuesday, the 7th of September next (1915).**

Plans and specifications can be seen on or after this date at the said office or at the Quebec Streams Commission's Office, Room 803, McGill Building, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for the sum of Fifteen Thousand Dollars ($15,000), made payable to the order of the Provincial Treasurer, must accompany each tender, which sum will be forfeited if the party tendering declines entering into : contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
O. LEFEBVRE,
Chief Engineer.
The Quebec Streams Commission,
Montreal, August 19th, 1915.

Newspapers inserting this advertisement without authority from the Commission will not be paid for it. 34-35

Tenders for Installation of Plumbing and Fixtures

Tenders, addressed to the undersigned, will be received by registered post only up to 12 o'clock noon on **Tuesday, September 14th, 1915,** for the complete supply and installation of Plumbing and Fixtures, etc., in connection with Public Lavatories at St. Lawrence Market, Toronto.

Copy of specification may be seen and tender form obtained, together with all information relative thereto, at the offices of the Property Department, City Hall, Toronto.

The usual conditions pertaining to tendering as prescribed by City Bylaw, must be complied with, and envelopes containing tenders must be plainly marked on outside as to contents.

A bond from a Guarantee Company, satisfactory to the Corporation, will be accepted in lieu of the personal sureties provided for in the tender form.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman Board of Control.
City Hall, Toronto, Aug. 28th, 1915. 35

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, September 10th, 1915

FOR

ALL TRADES

New School Building

Gledhill Ave., near Danforth Ave.

AND

Sale of Old Houses

to be removed from grounds at Dovercourt and Park Schools and grounds on Sydenham Street

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for 5 per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

W. C. WILKINSON,
Secretary-Treasurer.
MILES VOKES,
35 Chairman of Committee.

Tenders for Drainage Work

Sealed tenders addressed to Alex. McFarlane, Township Clerk, Otterville (marked Tender for Drain) will be received up to 2 p.m. on **Monday, the 13th day of September,** for the construction of the Bauslaugh Creek Drain near the Village of Otterville (5,100 feet of tile drain and 9,500 lineal feet of open ditch, 6,864 cubic yards); also tenders for the necessary tile will be received at the same time.

Plans and specifications may be seen at my office, Woodstock, or at the Clerk's office at Otterville.

F. J. URE,
35 Township Engineer.

Tenders for Construction of Pavements

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, September 7th, 1915,** for the construction of asphalt pavement on Ravensden Avenue, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, Aug. 31, 1915. 35

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, September 7th, 1915,** for the construction of concrete sidewalks on Conway and Oakwood Avenues, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, Aug. 31, 1915. 35

TOWNSHIP OF BRANTFORD

Fonger Bridge

Sealed tenders, clearly endorsed on the outside, "Tender for Fonger Bridge Abutments" or "Tender for Fonger Bridge Superstructure," will be received up to 5 p.m. on **Wednesday, September 8th, 1915,** addressed to the Township Clerk, County Building, Brantford:

"A"—For reinforced concrete abutments containing 225 cubic yards of concrete.

"B"—For steel superstructure Class "A" loading, 70-foot clear waterway, 16-foot roadway, with reinforced concrete deck and latticed handrailing.

Each tender must be on the prescribed form and accompanied by a marked cheque for five per cent. of the amount of the tender, made payable to the Treasurer of the Township of Brantford.

Plans and specifications may be seen at the office of the undersigned, Room 4 Temple Building, Brantford, from whom tender forms may be had.

ALAN MAIR JACKSON,
35 Township Engineer.

TOWNSHIP OF BRANTFORD

Winter Bridge and Hill Grade

Sealed tenders, clearly endorsed on the outside "Tender for Winter Bridge" or "Tender for Hill Grade," will be received up to 5 p.m. on **Wednesday, September 8th, 1915**, addressed to the Township Clerk, County Building, Brantford.

"A"—For reinforced concrete 20-foot skew span bridge with 16-foot roadway, containing 145 cubic yards.

"B"—For Winter Bridge Hill grade containing 4,553 cubic yards of cutting and a like amount of filling to form a 16-foot roadway.

Each tender must be on the prescribed form and accompanied by a marked cheque for five per cent. of the amount of the tender made payable to the Treasurer of the Township of Brantford.

Plans and specifications may be seen at the office of the undersigned, Room 4 Temple Building, Brantford, from whom tender forms may be had.

ALAN MAIR JACKSON,
Township Engineer.

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trical work to Paul Johnson, 761 William Avenue, Winnipeg.

Hull, Que.
Work has been commenced on alterations and improvements at the school on Riboul Street for the Roman Catholic School Commissioners. The contract for brickwork has been let to O. St. Laurent, St. Henri Street. Approximate cost of work, $6,000.

Port Colborne, Ont.
The contract for painting at the school now in course of erection has been let to James A. Guinter, Port Colborne, at $1,700.

Romney Township, Ont.
The following contracts have been let in connection with the school now being erected:—masonry and interior fittings, B. Blonde, 14 Cornhill Street; carpentry, J. Blonde, King Street, Chatham; plastering, F. Williams, Coatsworth, Ont.; painting, C. R. Guy, 8 Poplar Street, Chatham.

South Woodslee, Ont.
The general contract for the erection of a Town Hall has been let to Johnson & Rogers, Essex. Estimated cost, $3,000.

St. Louis Gilbert, Man.
The general contract for the erection of a school has been let by the Trustees of the Wakefield School District to Simmons Bros., 1200 Garfield Street, Winnipeg. Approximate cost, $6,500.

St. Theresas, P.E.I.
The contract for the completion of the Roman Catholic Church has been awarded to P. Bradley, St. Theresa. Estimated cost, $13,000. Architect, J. M. Hunter, Morris Block, Charlottetown.

Summerside, P.E.I.
In connection with the addition in course of erection at the Ottawa Street School, the contract for heating, plumbing and electric wiring has been let to Thomas Johnson & Son, Summerside.

Three Rivers, Que.
In connection with the school being built for the Roman Catholic School Commissioners, the contract for steam fitting, roofing and plumbing has been let to Germain & Frere, 87 St. Antoine Street.

Welland, Ont.
The general contract for the erection of three exhibition buildings for the Welland County Agricultural Society has been let to D. L. Weaver, Welland.

Weston, Ont.
A contract has been awarded to Lever Bros., Buttonwood Avenue, for the erection of an auditorium at the Toronto Free Hospital for Consumptives. Frame construction. Approximate cost, $6,000.

Winnipeg, Man.
The contract for plastering at the First Church of Christ (Scientist), in course of erection on River Street, has been let to the general contractors, Fort Garry Construction Company, Ross and Arlington Streets. Roofing and metal work contracts not yet awarded.

Business Buildings and Industrial Plants

Aylmer, Ont.
Thomas Wooster is about to erect a greenhouse at an approximate cost of $4,000, and is in the market for boiler and steam piping, glass frame work and greenhouse equipment.

Burnaby, B. C.
Tenders on the construction of an oil plant at Burrard Inlet for the Shell Oil Company, Fifth and Carolina Streets, Vancouver, are being received by the Architect, J. C. Storey, Northern Bank Building, Seattle, Wash. Work includes grading, erection of wharfage, crib work, warehouses and a number of steel tanks, with capacities varying between 5,000 and 38,000 gallons.

Cherry River, Que.
Leslie Buzzell has decided to rebuild his creamery, which was recently destroyed by fire.

Coaticook, Que.
E. O. Baldwin, Cutting Street, has commenced the erection of a barn on Morgan Street, and will be in the market for hoisting and carrying cranes.

Devizes, Ont.
Robert Lambert is erecting a number of farm buildings, at an approximate cost of $3,000. Frame construction, stone and concrete foundation, shingle roofing.

Glengowan, Ont.
Plans of a large concrete silo are being prepared by Adam Smith, Glengowan, St. Marys, Ont.

Levis, Que.
The erection of a large hotel is being considered by M. L. Doban, Victoria Hotel.

Montreal, Que.
A permit has been issued to the Ogilvie Flour Mills Company, Youville Square, for alterations to the factory at 21 Mill Street, estimated to cost $3,500. Architect, J. Bosse, 177 Chateauguay Street.

Ottawa, Ont.
Plans have been prepared for an office building to be erected for the Ottawa Car Manufacturing Company, 311 Slater Street, at an approximate cost of $4,000. Ironclad construction, felt and gravel roofing.

Port Arthur, Ont.
A permit has been issued to the National Elevator Company, Port Arthur, for the erection of an elevator at Third Avenue and King Street. Approximate cost, $15,000.

Thedford, Ont.
Work has been started by R. McKenzie on the erection of a garage and pool room, estimated to cost $4,500. Concrete block construction, concrete foundation, felt and gravel roofing.

Tilbury, Ont.
J. S. Richardson & Company, Queen Street, are preparing plans for exterior and interior alterations to their premises. Work will include new store front, remodelling of interior and new fixtures. Approximate cost, $3,000.

Toronto, Ont.
W. J. S. Tremain, 171 Keele Street, is receiving prices for carpentry work required in trimming seven stores at 382 Roncesvalles Avenue. Particulars on the job.

W. Davis, 3 Scarboro Road, is receiving tenders on the lathing and plastering required at the store in course of erection at Queen and Scarboro Streets.

Whitby, Ont.
The heating and plumbing work in connection with the garage being built on Dundas Street for W. J. Luke & Son will be done by the owners.

CONTRACTS AWARDED.

Brighton, Ont.
The D. J. Barker Foundry Company, Ltd., have let the contract for the erection of a foundry to Thomas Garnett & Sons, Port Hope. Estimated cost, $13,000.

Calgary, Alta.
Work is in progress on the erection of ten elevators for the Western Canada Flour Mills Company, Ltd., East Calgary. General contractors, Harper Construction Company, 130 Grain Exchange, Winnipeg.

Cornwall, Ont.
In connection with the stores being erected on Pitt Street for Robert Lalonde, the contract for concrete work has been let to Henry Williams, Cornwall.

Fredericton, N.B.
Concrete Builders, Limited, Gibson Street, have been awarded the contract for the construction of a concrete garage for A. B. Kitchen and Associates. Approximate cost, $4,000.

Ottawa, Ont.
In connection with the store being built at Bank Street and Third Avenue by John Sutherland, 216 Cooper Street, the contract for heating and plumbing has been awarded to McKinley & Northwood, Rideau Street.

In connection with alterations to a store on Sparks Street for L. N. Poulin, Ltd., the contract for electric wiring and installation of motor has been let to Costello & Crowe, 380 Bank Street.

Point Grey, B. C.
The general contract for the erection of a garage and stable for B. T. Rogers, 1531 Davie Street, has been awarded to the Dominion Construction Company, Ltd., 509 Richards Street, Vancouver. The general contractors are receiving prices on sand, gravel, cement, brick, lumber, reinforcing steel, gasoline hoist, from 6 to 10 h.p., gasoline concrete mixer, capacity between 1/3 and ½ yard. Approximate cost of work, $35,000.

Quebec, Que.
The contract for plastering at the station being built on St. Peter Street for the Transcontinental Railway Commis-

sioners has been let to Jean Labrecque, Fraser and St. Felix Streets, Levis.

Work has been started on the repairs to the printing plant of Le Soleil, 90 Mountain Hill. The general, masonry and carpentry contracts have been let to E. Paquet & Company, 16 Couillard St., and the contract for steel work to the Eastern Canada Steel & Iron Works, Ltd., 76 St. Peter Street.

Joseph Gosselin, Levis, has commenced the construction of a greenhouse for the Department of Public Works and Labor, Quebec. Brick and glass construction, concrete foundation. Approximate cost, $5,000.

St. Catharines, Ont.
The contract for carpentry at the moving picture theatre in course of erection on James Street for J. & J. Sullivan, Church Street, has been let to the Lincoln Construction Company, Ltd., Niagara Street.

The carpentry contract in connection with the stores being built on Queenston Street for E. Nicholson, Queen St., has been awarded to J. Carl, Mary St.

Work is progressing on the erection of an addition to the japanning building of the McKinnon Dash and Hardware Co. The contract for masonry work has been let to the general contractors, Newman Bros., 75 St. Paul Street, the contract for steel work to the Hamilton Bridge Company, Ltd., Bay Street N., Hamilton, and for steel sash to Steel & Radiation, Ltd., Fraser Avenue, Toronto.

Walkerville, Ont.
In connection with the factory in course of erection for the Dominion Stamping Company, the contract for sheet metal work and roofing has been awarded to Pennington & Brian, 47 Sandwich Street W., Windsor, and for plumbing to the Windsor Hardware Co., 71 Sandwich Street E., Windsor.

Winnipeg, Man.
The contract for the erection of a milk depot on Aberdeen Street for the Board of Control will probably be awarded to Simons Bros., 1200 Garfield Street. Stone and brick construction, stone foundation, felt and gravel roofing. Estimated cost, $7,730.

The contract for electrical work at the office building in course of erection on Main Street for F. W. Scott, 190 Kingsway, has been let to the Schumacher-Gray Company, Ltd., 386 Donald Street.

Residences

Fredericton, N. B.
A. E. Kilburn will probably rebuild his residence and barn on the Woodstock Road. Work will be done under supervision of Judson Barker, Northumberland Street.

Harriston, Ont.
Sidney French, Queen Street, has commenced the erection of a residence estimated to cost $3,500. Frame and white brick construction, concrete foundation, shingle roofing.

Leamington, Ont.
Work has been started on the erection of a residence by G. A. Campbell, Talbot Street. Frame and white brick construction, shingle roofing. Estimated cost, $3,000.

London, Ont.
Hyatt Bros., 94 Egerton Street, are building three residences on Windsor Avenue, at an approximate cost of $2,000 each. Sub-contracts for smaller trades will be let.

Montreal, Que.
Jean Brunette, 111 Grand Boulevard, has commenced the erection of two residences on Oxford Street, estimated to cost $16,000. Architect, Z. Trudel, 238 St. Andre Street.

Work has been started by J. Leman, 259 Ontario Street E., on alterations to two residences at 400 St. Denis Street, estimated to cost $4,000.

New Canaan, Ont.
John Renaud, New Canaan, Essex, Ont., contemplates the erection of a residence to replace that recently destroyed by fire. Approximate cost, $3,200.

Niagara Falls, Ont.
Bond & Smith, Architects, 15 Wilton Avenue, Toronto, will shortly call for tenders on the erection of a residence for E. R. Dewart, Manager of the Royal Bank, Erie Avenue. Estimated cost, $7,000.

Ottawa, Ont.
The erection of a residence on Sunnyside Avenue is being considered by J. M. Hutt, 648½ O'Connor Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

Quebec, Que.
Alfred Letarte, 386 Richardson Street, has started work on the erection of a residence on Charlesbourg Road. Brick construction, concrete foundation. Estimated cost, $5,000.

Renfrew, Ont.
Tenders on the erection of three double residences will be received until September 6th by W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa. Estimated cost, $10,000.

Sudbury, Ont.
Two residences and a barn are being built on Station Street by P. Taylor and Mark Genaro. Work by day labor.

Toronto, Ont.
Work has been started by S. B. Green, 650 Annette Street, on the erection of a residence at 111 Evelyn Crescent, estimated to cost $3,000. Brick construction, shingle roofing.

Plans have been drawn for a pair of residences to be built on Roehampton Avenue by T. Prest, 262 Annette Street, at an approximate cost of $4,000. Brick construction, shingle, felt and gravel roofing.

R. J. Rogers, 196 John Street, has commenced the erection of a residence on Glendale Avenue, estimated to cost $3,000. Smaller trades will be let. Brick construction, shingle roofing.

W. John, 1 Leeds Street, is receiving tenders on heating, plumbing, wiring, plastering and painting required at the residence in course of erection at 6-8 Cuthbert Crescent. Plans may be seen on the job.

Work has been started on the erection of a two-family residence at 58 Ford St. by W. S. Grimshaw, 462 Avenue Road. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,000.

D. Gould, 4 Elmwood Avenue, is receiving prices on plumbing, heating, plastering, painting and wiring in connection with the residences which he is building at 58 Goodwood Avenue. Estimated cost, $3,000.

E. Sykes, 1796 Dufferin Street, has commenced the erection of a residence, estimated to cost $3,500. Smaller trades will be sub-let. Brick construction, shingle roofing.

Work has been started bp J. W. Clare, 68 Ascot Avenue, on the erection of a residence at 1759 Dufferin Street. Stone and brick construction, shingle roofing. Approximate cost, $3,500.

The erection of a residence has been commenced by W. Wills, 49 Lee Avenue. Smaller trades will be sub-let. Estimated cost, $4,000. Brick construction, shingle roofing.

Westboro, Ont.
W. E. Noffke, Architect, Plaza Building, Rideau Street, Ottawa, is receiving tenders until September 6th for the erection of a residence for C. Ogilvy, Rideau Street, Ottawa. Estimated cost, $6,000.

Whitby, Ont.
Plans are being prepared for a residence to be erected for Robert Thompson, at an estimated cost of $4,500.

CONTRACTS AWARDED

Charlottetown, P. E. I.
A residence is being built on Euston Street by W. Hennessey, Euston Street, for J. J. McKinnon, Sidmount. The contract for heating has been let to James McEachern, 34 Upper Queen Street. Plumbing not let.

In connection with the residence erected on Brighton Road for W. H. Tidmarsh, the plumbing contract has been let to Stanley Shaw & Peardon, 161 Great George Street, and the heating contract to James McEachern, 34 Upper Queen Street.

London, Ont.
In connection with the residence in course of erection on Richmond Street for Mill J. Lashbrook, the following contracts have been let:—Carpentry, S. Jeffrey, 87 Maitland Street; plastering, John Fenn, 752 William Street; plumbing, Hunt Plumbing Company, 533 Richmond Street; furnace work, Smith & Johnston, 92 Fullerton Street; painting, G. Howe & Son, 488 Elizabeth Street.

Malden, Ont.
James M. Gibb, Malden, has commenced the erection of a residence for Guy Campbell, Gravel Road, Malden, Amherstburg, Ont. Frame and white brick construction, stone and concrete foundation, shingle roofing. Estimated cost, $3,000.

Milton, Ont.
The Halton County Council have let the contract for the erection of a jailer's residence to David Menzies. Approximate cost, $4,000.

Montreal, Que.
Roberts & Pick, 112 Addington Avenue, have commenced the erection of two flats for T. Senecal, 4226 St. Catherine Street. Approximate cost, $5,000.

Ottawa, Ont.
The general contract for alterations and additions to apartments on Waverly Street for T. G. MacLaughlin, 315 Frank Street, has been let to Ernest Sanders, 377 Somerset Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,500.

The general contract for the erection of a residence for Mrs. Loyer has been let to J. H. Croteau, Westboro. Brick veneer construction, stone foundation, felt and gravel roofing. Approximate cost, $4,500.

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The following contracts have been let in connection with the residence being built on Bellwood Street for the Oakland Land Company:—masonry, B. Dougherty, 16 Cayuga Street; carpentry and roofing, W. Fryer, 5 Glen Avenue; plastering, Bowman & Sons, 239 Florence Street; painting, Ritchie & Nunn, 163 Sunnyside Avenue; heating, Pease Foundry Company, Ltd., 287 Lyon St.; plumbing, F. Gervin, Bank Street and Sunnyside Avenue; electrical work, Dominion Electric Company, 417 Sparks Street.

St. Catharines, Ont.
The contract for heating, plumbing and metal work at the residence built on Glenridge Street for F. N. Hara, College Street, has been let to J. Peart, King Street.

Three Rivers, Que.
In connection with the residence in course of erection for Alexander Craigan, 8 St. Prospect Street, the following contracts have been let:—plumbing, roofing and steam fitting, Charles Hamelin & Son, 3 St. Oliver Street; cement block work, Paul Dumonlin, 70 Champflour Street; plastering, D. Lambert, 44 St. Genevieve Street.

Toronto, Ont.
The contract for plastering at the residence being built on Roxboro Street E. for W. L. McFarlane, has been let to T. Petrie & Son, 495 Dupont Street.

F. M. Connell, 171 Spadina Road, has commenced the erection of three residences at 4-12 Prospect Street, estimated to cost $15,000. The contract for masonry, carpentry and plastering has been let to John Richards, 1 Clinton Avenue, Wychwood.

The general contract for the erection of a residence on Runnymede Road for A. Poyntz, 426 Queen Street W., has been let to Wibby & Hewson, 190 Silver Birch Avenue. Smaller trades will be sub-let by the general contractors. Brick construction. Approximate cost, $3,500.

Power Plants, Electricity and Telephones

Listowel, Ont.
The by-law for the installation of a hydro-electric system has been carried. Tenders for the work will be called for shortly. Town Clerk, W. Bright.

Saskatchewan Province
The following rural telephone companies have been authorized to borrow money for the construction of their systems:—Baring Rural Telephone Company, $4,000, Secretary, Robert Auld, Baring; Petrolia, $3,000, A. G. Davis, Petrolia; South Forget, $4,000, J. W. Lemay, Forget; Sprattville, $6,000, Thomas Mason, Girvin; Storthoaks, $15,000, C. A. Handfield, Storthoaks; Young, $5,500, L. J. Preston, Young.

CONTRACTS AWARDED

Ottawa, Ont.
The Department of Public Works have let a contract for the supply of tungsten lamps to the Canadian Tungsten Lamp Company, 428 Canon Street E., Hamilton.

Fires

Amherst, N. S.
The residence of George Betts, Dundonald Street, has been totally destroyed by fire. The loss is partially covered by insurance.

Austin, Man.
E. A. Stout's machinery warehouse has been totally destroyed by fire, with a loss of $1,500 on the building and about $1,000 on machinery. Some insurance was carried.

A barn belonging to Charles Robinson has been destroyed by fire. Loss, $6,000.

Aylmer, Que.
The frame and shingle cottage owned by Charles Magee has been totally destroyed by fire. Loss, $3,000.

Carlton Corner, N. S.
Fire has completely destroyed a barn belonging to G. C. Langley, St. James Hotel, Bridgetown.

Chicoutimi, Que.
Fire has destroyed a warehouse, the property of Massicotte & Tremblay. Loss between $15,000 and $20,000.

Kempville, Ont.
Fire has destroyed the residence of T. A. Murphy. Loss, $4,000, partially insured.

Lac Sergent, Que.
A barn and stable belonging to Mrs. Pacquet have been entirely destroyed by fire. The loss is partially covered by insurance.

Madoc, Ont.
A double residence belonging to D. E. K. Stewart, Prince Albert Street, has been destroyed by fire. Loss, $6,500.

Montreal, Que.
Fire has damaged the business premises of R. E. Thorn at 335 Craig Street W. Loss, $2,000.

Murray Bay, Que.
Fire has destroyed the laundry and boiler room of the Manoir Richelieu, and the main building has been damaged by water, causing a loss of $50,000. Owners, Canada Steamship Lines, Ltd., Yonge Street, Toronto. Local Manager, C. E. Phenix, Murray Bay. The company will rebuild.

Newcastle, N.B.
The residence of Mrs. B. Stewart, King's Highway, has been entirely destroyed by fire.

Ottawa, Ont.
Fire has destroyed stables on Stewart Street, the property of J. B. Duford, Rideau Street. Loss, $3,000.

Petrolia, Ont.
Fire has recently destroyed the store and Post Office, owned by J. C. Waddell. The loss is fully covered by insurance.

Point Grey, B. C.
The residence at 34th Avenue and Larch Street, belonging to A. Martin, 1151 Eighth Avenue W., has been destroyed by fire. Loss, $3,000, partly covered by insurance.

Quebec, Que.
Fire has destroyed a storehouse, the property of the St. Lawrence Bridge Company, Ltd., Quebec Bridge and 59 St. Peter Street, Montreal. Loss, $15,000.

Selkirk, Ont.
Elmo Holmes' store has been destroyed by fire.

Sherbrooke, Que.
Fire has totally destroyed the mill of the Eustis Mining Company, Eustis St., causing a loss of $50,000.

Sillery, Que.
Fire has destroyed three residences and a carpenter shop belonging to Oliver Gignac, a residence and blacksmith shop, the property of Madame C. Jolin, and residences belonging to the following:—E. Moussette, L. Robitaille, Estate of Madame lavet, A. Girard, Madame P. Bedard, R. Tobin, E. Gignac, Estate of J. Tierney, J. Moussette, E. Vallier, J. Fortier, A. Morissette, Miss A. Gignac.

St. John, N. B.
A block of stables belonging to the Sisters of Charity, Cliff Street, has been destroyed by fire. The loss is fully insured.

Winnipeg, Man.
Frank Striber's bakery at 34 Disraeli Street has been destroyed by fire. Loss, $3,000, covered by insurance.

Miscellaneous

Dorchester, Ont.
The Southern Ontario Gas Company, 580 Talbot Street, St. Thomas, are considering the construction of gas mains and connections in Dorchester. Manager F. B. Tomb, London.

Gravenhurst, Ont.
The Muskoka Lakes Association are considering the installation of four to six small steam pumps at various points for fire protection. Particulars from W. F. Wasley, Manager, Muskoka Navigation Company, Ltd., Gravenhurst, Ont.

Quebec, Que.
Tenders will be received until noon, September 16th, by the Acting Secretary to the Quebec Harbour Commissioners, for the supply of 500 pieces of 12-inch by 14-inch square oak, in lengths of 12 feet and up, the average length to be not less than 22 feet.

Toronto, Ont.
Tenders on the erection of a radial brick chimney at the Don Roadway Incinerating Plant will be received until September 7th by the Board of Control. Plans and specifications at office of the Street Commissioner, G. B. Wilson.

Welland, Ont.
Ryan & Gardner, Main Street E., are receiving prices, catalogues and other information with reference to brick, cement, hollow tile, steel, metal lath, screens, weather strips, rock drills.

Winnipeg, Man.
Prices, catalogues and other information with regard to concrete mixers, steam pile drivers and reinforcing bars are being received by Buchanan & Company, P. O. Box 154, Winnipeg.

CONTRACTS AWARDED

Lachine, Que.
The contract for the construction of an incinerator has been let bp the City Council to the Atlas Construction Company, 37 Belmont Street, Montreal, at $9,000.

Point Pelee, Ont.
The contract for the erection of a light house tower has been let by the Department of Marine and Fisheries, Ottawa, to Charles Mattaini, Tower Street, Fergus, Ont., at $8,490.

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Canadian Contractors Ask a Fair Field and No Favor—Nothing More

JUDGING by the letters published in this issue, the editorial article "Patriotism in Awarding Contracts" published in our issue of August 25 struck a popular note. The letters are interesting not only as showing that the contracting interests in this country are united in their resentment of importing foreign contractors to put up Canadian buildings, but as bringing out many divergent views worthy of consideration.

Too often in a discussion of this kind there is a sameness about the views advanced—something stereotyped which impels one to seek diversion in other pages. In these letters, though, there is material food for reflection. In each there is at least one point which stamps the letter with the hall-mark of individuality.

To review the whole matter again would savour of repetition, the editorial in our issue of August 25 having provided the details; but for those whose attention may be given to the matter now for the first time it may be said that in our previous article strong objection was taken to The Robert Simpson Company's award of a contract for an office and warehouse building in Regina estimated to cost nearly half a million dollars to a Chicago firm.

The claim of distinctiveness that has been made for the articles is not hard to establish. One of the least voluminous of the letters raises an interesting point as to the duty paid on the plans. In the reports of this work received to date no mention has been made of an architect—from which it is fair to assume that the plans have been imported. In this case what duty has been paid? It would be interesting indeed to know whether the Canadian architect and the Canadian contractor have at least this small protection which the law affords, or whether the Customs authorities are still being hoodwinked.

Two of the writers take the stand that in any case the Chicago firm will have to employ local labor and buy local material pretty largely, and that it comes down to a question of profit, which at such a time as this is essentially problematical. True; and it is by no means probable that the firm will make a fortune out of the job. But that is not the issue: the moot-point involves a principle—a principle of sufficient importance to be considered one of the pillars of the contracting business in Canada. Stated briefly, this principle is that the ability of Canadian contractors may no longer be discredited in favor of our competitors across the line, and that we are at least entitled to a fair field and no favor. For this principle The Contract Record stands unequivocally. With the best wishes in the world for the success of our "American cousins," and with a whole-hearted desire to improve and maintain business relations between two peoples having so much in common—the success of the one being, as it were, complementary to the success of the other—we maintain that in their own country, if any preference is going, Canadians should get it. We can only reiterate our former contention—that to pass up all our big Western contractors in favor of a Chicago firm is consummate injustice.

Finally, we would reply in a word to one correspondent who declined to enter into the discussion on the ground that the other side of the story had not been heard. It is sufficient to say that The Robert Simpson Company's attention was directed to our former article, and that they received an invitation to state their case—an invitation which was evidently considered to refer to a trifling matter, as it was not acknowledged.

Pour Encourager Les Autres

TO such an extent have Manitoba and Western Canada been dragged through the mire over the Parliament Buildings scandal, and such a nauseating effect have the details produced upon the man in the street, that the only justification for referring to the topic, however briefly, is the fundamental consideration in the punishment of all crime—the deterrent effect upon others.

The sweeping findings of the Royal Commission came as a shock to every decent-minded citizen of Canada, and nothing but the arrest and prosecution of the Government Ministers under whose administration such crimes were possible could satisfy the outraged public mind. Never before did investigation disclose such a heartless betrayal of the country. From beginning to end it was one long story of bribery and corruption, illegal profit, "grave irregularities," excessive prices, fraud, faked plans, over-charges, over-payments, and criminal conspiracy. It seems incredible that on this one contract the estimated over-payments should have run into nearly one million dollars, and that on the steel contracts alone the loss was over $400,000.

Now we have the arrest of that arch-conspirator Sir Rodmond Roblin, the ex-Premier, together with his myrmidons Montague, Howden and Coldwell. They have been released on comparatively small bail—a mere $50,000 each—on a charge of conspiring to defraud the public. It is to be hoped that their prosecution will be pushed vigorously, and that the people of Manitoba—and for that matter the people of all Canada—will not be bluffed in the measures taken to apprehend them. The only punishment that can fit such a crime is the punishment allowed by the full letter of the law in the particular category of that crime. Nothing less will suffice.

Politics aside, in this malodorous case we have the last straw added to the burden of a long-suffering people. We must break the backs of these high criminals or they will break ours.

Is the President and General-Manager of the Great North-Western Telegraph Company to be overlooked?

Nothing Remains?

IN response to an invitation to contribute an article for discussion in these columns we received a reply from an engineer who made the following statement in the course of his letter:

> "The European War is the subject which is engaging the attention of everyone just now, and it is being discussed to such an extent that nothing appears to remain for a technical journal to deal with."

We are sure our correspondent will not be offended if we use his letter as a text for a few observations.

No one can deny that the War is absorbing our attention, for most of us have some close connection with it. But while our energy, our talents and our knowledge—individually and collectively—are at the disposal of our Country to carry on the present terrible conflict to a victorious issue, it must not be forgotten that there also remains a civil duty to perform. While our young, able and valiant men are fighting at the front, those who remain at home are carrying on a highly important duty, for the men at the front cannot continue to fight unless those who have to remain behind support them.

Further, technical journals are concerned in the War quite as much as the "dailies." The daily papers and their readers are interested in the social, military and political features of the campaign. By political we mean international politics, for in the British Empire to-day there can be but one class of politics, and that is to drive the War to a glorious conclusion. The technical press also is interested in personal exploits and in international competition for supremacy, but its horizon is more extensive, for it is concerned in the wonderful developments of the science and art of war. In some anomalous way war is instrumental in producing many scientific achievements that would otherwise be left untouched. Many of the things we enjoy at the present time are the products of war or war preparations. Explosives, for instance, were not used—although the Chinese had discovered gunpowder centuries before—until the soldiers in the 16th century wanted to destroy fortifications, and since then the use of explosives has been extended to almost every field of civil and military operations. Even to-day the production of higher explosives is the demand of the hour. We need guns which will outmatch the enemy's guns. Submarines, which were scoffed at a few years ago have, through the ingenuity induced by war, been converted into machines of hellish destructiveness.

We need not follow along the line of the development of destructive science and art. It will pay us also to study the constructive side of war.

Expedition is the essence of military success. Speed counts, and anything and everything which military men can utilize to expedite their operations is used. Expense is not considered: it is almost forgotten; and if any machine or device can be brought in to execute field work in less than the ordinary time, or add to the efficiency of the men, it is commandeered. In the manufacture of shells and guns, in the improvement in quality of materials, in the invention of devices, implements and combinations, and so on, it is ever a race for the best. Never previously was the demand for superiority so great as it is now, and never before in the history of the world has there been such a colossal demand for brains—brains to direct, brains to invent and improve, brains to rivet public attention on the need of the moment, and brains to lead.

The technical journals have an important function to fulfil at all time. They should be the very heart and sinew of the professions and trades, focussing thought on the best, encouraging new developments and advocating new ways, discussing the uses of various machines and materials in the art of war. In this connection Canadian technical journals are called upon to do their best, and Canadian scientists should take a prominent part in the research for new and better materials—more even than in the past. Now engineers have an opportunity for displaying the ability of adapting themselves to new and strange conditions, and for acquiring knowledge which will be valuable at all times. Manufacturers have the chance of showing the world that their machines, implements and materials are equal if not superior to those of other countries, and that when demand arises for something different they are ready. The war makes a demand on almost every class of manufacture.

These columns are always open for the description of those products which are used on constructional work. The fund of material available for a technical journal to deal with is as abundant to-day as ever it was, and when considered from a truly patriotic point of view there should be a keener desire to advance the profession or business by a thorough discussion of every topic. This will tend materially to promote Canadian interests and British success.

It will be a sad day for this country if we allow the War to be so distracting as to remove from our minds all thought of development or progress. The country must advance, however slowly, in spite of the War and its effects, or we shall find ourselves on the retrograde; and progress can best be accomplished by maintaining a national, professional and commercial sang froid. Engineers—to whichever branch they belong—will best serve their profession and their country by remembering the duty they owe to their fellow-men.

We thank our correspondent for the opportunity of drawing attention to an opportune and interesting subject.

Accidents in Road Construction

THE prevention of accidents is of the greatest importance to road contractors. It is well recognized that freedom from accidents, aside from the money saving and reduced premiums, enables the contractor to build up an organization that is more efficient because it has confidence in itself and in the construction methods that are being used.

One of the principle sources of accidents on road work—and many of them are fatal—is blasting. Dynamite requires extreme care in handling, and should be placed in the exclusive charge of a safe and competent man. This man should see that the charges are of the proper size, and that fuses and caps, or blasting machines and wiring, are in first-class condition. The foreman should select a place of safety and see that all the workmen reach it before allowing the blast to be fired. Men should be assigned to warn persons passing near the work. Heavy rope mats and logs bound together by chains are absolutely necessary to prevent flying debris in work near cities and towns, and their use often pays in more open country. In one instance, a man standing in his own yard a quarter of a mile from where blasting was being done on road work without such a mat was struck by a small piece of rock and instantly killed.

The most serious accidents are often caused by men returning to work too soon after a misfire. Numerous cases have demonstrated that, where fuses are used, it is not safe to venture near a misfire for several hours. In one instance several workmen were killed by a blast fired with a defective fuse which did not go off for half an hour after it had been decided that all danger was over, and the men had been sent back to work.

Felling trees in clearing for road work is another fruitful source of accident, and this work should be done carefully by experienced men. Constant vigilance must be employed to prevent accidents from landslides in making cuts for road work. Especially is this true where men work on the top edge of the cut.

Care should be exercised by men working around a steam shovel, and the foreman should see to it that the men keep in the clear, and that the shovel is properly handled and kept on a solid foundation. Many wagon drivers become too lazy or careless to get down from their seat while their carts are being loaded. Drivers should be compelled to do this by the foreman; if they remain in their seats, they are in danger of being struck by material falling from the dipper, or of being brushed off by the dipper itself.

Handling the materials used in road making is also a prolific source of accident. Caution should always be exercised to pile cement bags, paving blocks and other material solidly so that they will not fall over and injure some one. Loading and unloading oil barrels and other heavy objects should not be attempted with a green crew, as lack of co-operation by the men, or the misunderstanding of an order, is almost certain to result in injury to some one.

Many accidents are reported each year from overcrowding of the men at work, or from the carelessness of the men where there is plenty of room. The men will always go to the point indicated by the foreman, and will crowd themselves together without regard to the danger of striking each other, if they think they have been ordered to do so. It is well known that the man in charge can get more work out of his men by placing them so that they will not interfere with one another, and care should always be taken to see that this is done.

Many accidents have been caused by reckless automobile drivers rushing at high speed past points where road work is going on, and either striking some of the workmen or throwing in the air tools that have been left in the roadway. The roadway should at all times be kept clear, and the Travelers Insurance Company suggests that contractors who suffer from the acts of drivers of this class erect solid barriers at each end of their work, forcing such men to come to a dead stop before they are allowed to proceed.

The Engineering of Poison Gas Warfare

IN clean fighting the German is beaten every time, comments our London contemporary and namesake, The Engineering Review. It is only when he descends to methods forsworn by every civilized nation—including his own in the days when it was still considered civilized and honourable—that he scores temporary success. The Hun considers the use of poison gases, acid sprays, burning oil, and the rest, to represent the highest development of scientific warfare and 'kultur.' They do nothing of the kind, at least so far as concerns scientific warfare. The use of suffocating fumes, molten metal, and burning oil date back to the most barbarous times of mediaevalism, from which the principles of German 'frightfulness" have come down unchanged.

The twentieth-century Hun can make more noxious gases than could his forefathers. He can make more of them, and he can spray his acids and his burning oils a little further, but he cannot do anything which his antagonists cannot equal or excel, and, like the whole policy and methods of German warfare, his latest fiendishness presumes passive inactivity on the part of his enemies. Reluctantly enough, the Allies have been compelled to announce that they hold themselves justified in using whatever weapons are employed against them should circumstances so demand. Surprised by the use of forbidden means, the Allies have suffered temporary reverses in the past, but, knowing such means are to be used against us, and compelled as we are to use them in our turn, we have no fear for our powers of defence and offence. The assets of Germany were speed, numbers, and new weapons—and each of these has passed its zenith and dwindles daily.

To what extent the Allies will make use of these weapons which Germany's action has literally thrust into their hands depends solely on expediency. As to our ability to make and use them there cannot be an instant's doubt. It is but an elementary problem to set our chemists to produce chlorine, bromine, sulphurous acid, or any others of this dreadful series in any desired quantity. Cost is no object. As a matter of fact, it would be relatively low, and one of the strangest features of the last twelve months' campaign has been the use of the simplest, even the crudest, weapons as effective auxiliaries to artillery, machine guns, and rifles of most complex and costly construction.

The flame projector, for instance, which has been used against barbed wire, for incendiary purposes and —to the everlasting credit of German kultur—against men, is practically an exaggerated plumber's blowlamp. A tank carried on the operator's back contains oil and compressed air in separate chambers. The air is used to eject a far-reaching spray from a jointed or flexible tube and—voila tout!

Poison gas apparatus is equally simple. If used in shells the latter are simply filled under pressure, and burst by any of the means employed in other projectiles of similar calibre. If used from portable cylinders the latter are built and filled as in the case of the gas cylinders regularly used for various industrial purposes, a special distributing nozzle and possibly a protective lining inside the cylinder being the only modifications required. Central generating plant and distributing pipes of a permanent nature offer no greater difficulties to the engineer, though obviously there is greater risk of wholesale disaster to the users of the apparatus should gunfire damage the generator or pipe system. Several contretemps of this nature have already befallen the enemy, and bearing in mind this risk and the absolute dependence upon atmospheric conditions to carry gases liberated in the desired direction, it will be seen that however formidable poison gases may be under some circumstances they are not in the same category as artillery so far as concerns certainty and flexibility of action.

Asphyxiating shells combine the distinctive features of poison-gas warfare with the accurate, long range action of artillery fire, whilst eliminating many of the risks to the user. In one sense lyddite and melinite shells are asphyxiating, for on explosion they emit volumes of nitric oxides which are poisonous, but the main effect of these shells, and that for which they are designed, is the explosive effect. The poison cloud formed by bursting many lyddite shells in a limited area does not contravene the articles of the Hague Convention, and is very different from the cloud produced by shells which explode only to liberate their asphyxiating contents.

It would not be politic to discuss in too great detail the nature and manufacture of the various poison gases which have lately been used. Gases from burning sulphur, pitch, and charcoal were employed before the Christian era, and their use has been revived by the pagans of to-day. In addition, bromine and chlorine have been employed, the latter a by-product in the electrolytic manufacture of caustic soda. We have shortage of neither means nor material for manufacturing any desired quantity of any asphyxiant. Whilst poison gas is in modern warfare a new weapon, it is not one which will win the war for either side. Like every weapon, it will cause casualties, and those unfortunately of a particularly distressing nature—so distressing, in fact, that the Allies would never have taken up its use save in self defence—but there are means of defence against it, and the weapon is by no means infallible.

The use of fans or compressed air jets may protect particular points. The use of compressed air shells or shells containing counteracting gases may disperse or neutralize clouds of gas, possibly with incidental extensive explosion, but the chief onus of defence lies with the respirator. Though the materials are not those of everyday engineering, it is the activity and products of the engineer which have made possible the speedy manufacture of respirators in adequate numbers. A large scale poison gas attack may make conditions unbearable twenty or thirty miles away if proper defensive precautions be not taken, but, given the latter, the gas is relatively ineffective. For instance, in a great attack towards the end of May, when a poison cloud 40 ft. high was produced over our lines, the latter remained intact. In short, poison gas, now it is expected, can be dealt with suitably by the Allies, whilst the German, whose resources both of mind and material are distinctly limited, may live to rue the day on which he added physical to moral poisoning of the air.

FAILURES in the use of any new material or method of construction are of the utmost importance, because a proper study of the nature of the failure will do more to put the novelty on a sound basis than a hundred partial successes. A case in point has just occurred under the Epsom Urban District Council, and is reported by the London Sanitary Record. A large storm relief sewer of reinforced concrete tubes, said to weigh 21 cwt. each, has just been laid in a deep trench alongside the foot of a railway embankment, and fourteen of them are now found to be cracked horizontally. The question is, what is the cause of the cracks? The tubes were made by an experienced firm and tested at the works before delivery. One cracked at a pressure of six tons, but this was considered to be due to its "green" condition, having only been made about three months. Others bore eight to twelve tons without being affected. The specification is said to have required them to bear a load of eighteen tons, but it is not stated whether this load was applied.

TO move a dragline excavator over soft material where the bucket would not hold, the Winnipeg Aqueduct Construction Company turned the machine around, hitched the bucket to a chain run through the bed of the excavator and fastened to the front edge of the advance platform section, and moved the excavator by backing it up. According to the Excavating Engineer, the machines that were moved in this fashion were being operated in muskeg swamps. To pull them ahead in the usual way by casting the bucket out in front of the machine required digging away 4 to 6 ft. of this soft vegetable mold before the underlying clay, in which the bucket could get a firm hold, was reached. In principle the method is the same as that often employed to move traveler derricks, where the load line is attached to the track, and the engineer booms down and picks up his load, backing up the traveler. In each case the weight on the track or platform of the rig being moved furnishes sufficient anchorage to hold the pull needed to make the move.

"Patriotism in Awarding Contracts"

Wherein a Number of Representative Firms, Readers of this Journal, Criticize the Part of a Toronto Departmental Store in Failing to Recognize Its Responsibilities to Canadian Contractors

A Matter for the Builders' Exchange

Editor, The Contract Record:

We are heartily in sympathy with your views regarding the Regina contract, and we hope that the matter will receive the attention it should through your periodical.

It is not hard to find instances paralleling the one at Regina. In many cases work has been let to foreign firms while our old-established concerns, purely Canadian in composition, have not been given a chance to compete.

We might suggest that this matter be taken up by the Winnipeg Builders' Exchange, where no doubt a resolution could be obtained voicing the opinion of the contracting community in general.

Yours truly,
C. W. SHARP & SON.

Winnipeg, August 28, 1915.

* * *

Problematical Profits

Editor, The Contract Record:

Naturally we are sorry to see work given to U. S. contractors unless it is impossible to get it done by Canadian firms, but as we have not heard The Robert Simpson Company's side of the story we hesitate to commit ourselves.

As far as affecting labour or material is concerned, we do not think that this is an important factor. It is hardly likely that the contractors would think of importing labour and paying railway fares except in a few special cases; and naturally they will buy local material if it is cheap; so that neither the mechanic nor the material man should suffer. To our way of thinking, the matter resolves itself into the amount of money leaving the country and going into the pocket of an American concern. This amount would be the profit on the contract—and of course profits are usually problematical.

Yours truly,
A CANADIAN FIRM.

* * *

A Letter Which Gives Interesting Details

Editor, The Contract Record:

We cannot commend too highly the manner in which you have treated the subject of the Regina contract. The Robert Simpson Company undoubtedly depend upon the Canadian buying public for their profit, and it appears to us to be a very short-sighted policy for them to imagine that their business can be increased or bettered in any way by denying Canadian contractors the privilege of tendering on their Regina building. Any firm whose business is located in Canada should realize that their business will be greatly improved by the success of Canada as a whole. We do not take the narrow stand that a wall should be built around Canada, and that outside firms should be excluded entirely, but we do say that such firms and Canadian firms should be allowed to compete on a legitimate basis, and that all things being equal the Canadian firms should receive the preference. This should apply to any line of business, and much more so to an enterprise which depends upon the Canadian public for its trade.

The Robert Simpson Company cannot have had any good business reason for handling their letting in such a manner. Your editorial states: "The explanation was forthcoming that it was first the Simpson Company's intention to give the work to an Eastern contractor who had done satisfactory work for them previously, but later that it had been decided to allow three Regina contractors to figure, and that these would have the preference."

As an indication of the exceeding fairness (?) of the Robert Simpson Company and their great desire to favor Canadian firms, we might say that on July 26th a representative of the successful contractor appeared in the city of Regina and requested prices on various materials, stating that he was not making up an estimate, but that he was ready to give orders for all materials immediately upon his return East; and that he would commence operations on the building the first week in August. The latter part of the same week, the Robert Simpson Company's agent issued, over a period of two days, two incomplete blue-print plans of the building, a brief outline of the proposed specifications, and a photograph—supposed to represent the type of building.

On July 29th, at 5.55 p.m., the last sheet of incomplete specifications was delivered with a letter, stating that tenders were to be in the hands of the Robert Simpson Company at Toronto on Monday, August 2nd, and that the contract would be awarded August 3rd.

It is evident from this that no contractor could design the building, as was desired, and submit strain sheets, also required, in the time allowed. It is significant that although the Robert Simpson Company's agent stated that no architect had been employed, no plans had been drawn and no contract let, yet the Chicago architect was in the city of Regina on or about July 26th in consultation with the Simpson Company's agent and the representative of the successful Chicago contractor; and it is interesting that the building is being constructed in accordance with the original information supplied by the Chicago contractor's representative and not in accordance with the fake plans and specifications supplied three or four of the Regina contractors by the Robert Simpson Company's agent.

It would appear that there were two sets of plans in existence: one for an all-concrete building with a rubbed concrete finish, and another for reinforced concrete skeleton with brick curtain walls, or brick and tile curtain walls. It would appear that the Robert Simpson Company attempted to satisfy local sentiment, which favored letting the contract to a local contractor, by requesting tenders on a date they knew would not allow intelligent tenders to be presented by Canadian contractors.

Had the Chicago contractor submitted a tender on the same basis as the Canadian contractors, we could not severely criticize the letting of the contract to an outside firm, although the difference in prices should have been considerable to justify bringing in a foreign contractor.

In contradistinction to the Robert Simpson Company's action is that of the Ford Motor Company of Canada, Limited, who this week received tenders from a great number of Canadian contractors. We do not know whether any contractors from the States submitted tenders on the proposed Ford building, but we do know that both the Ford Motor Company of Canada and their engineers, Messrs. Wells & Gray, of Toronto, have afforded every facility (in the limited time they had at their disposal) to contractors desiring to tender. From the manner in which the plans and specifications were drawn, and from the correspondence between the parties involved, it is evident that the contract will be let on a fair and square basis; and we do not believe that any contractor will have occasion to feel that his tender was not given full, careful and honest consideration.

We cannot refrain from joining in the hope that the Robert Simpany Company's venture will be attended by scant success, for we cannot see that they have deserved the patronage of those interested in furthering the development of Canadian business and Canadian industry. No explanation they can make will ever eliminate the fact that Canadian contractors were non persona grata with the Robert Simpson Company, Limited.

Yours very truly,
WESTERN CONTRACTOR.

* * *

Patriotism and Business

Editor, The Contract Record:

We are in general accord with the principles outlined in your editorial article "Patriotism in Awarding Contracts." It is surprising that a firm like the Robert Simpson Company, who get every cent of their income from Canadian mechanics and Canadian workmen, should have the nerve to let contracts to outside parties. Evidently some kind of pressure was brought to bear against the interests of Canadian contractors. Sufficient information about the proposed building was not forthcoming, and firms who would have been interested in the undertaking had no opportunity of figuring.

One would imagine that a firm like the Simpson Company would have realized by this time that by giving contracts to Canadian firms they help Canadian workmen to keep their jobs, and that the workmen in turn give their money to the Simpson Company, which enables them to keep their employees in their jobs. Patriotism apart, surely it is only a matter of good business for us to keep as much money in the country as possible.

Yours truly,
R. M. ROY.*

Hamilton, August 31st, 1915.

* * *

The Matter of Plant and Equipment. Was Duty Paid on the Plans?

Editor, The Contract Record:

It may be of interest to state that the successful Chicago contractor for the Simpson Company's building at Regina has rented most of his equipment from local contractors, who were given no opportunity to submit tenders on the construction of the building.

This brings up a point as to whether the contractor when purchasing plant and equipment is buying this for his own use or whether he is buying it with the idea of leasing it to competitors. Plant and equipment are part of a contractor's capital, and we believe that as a business proposition it is very poor policy for a contractor to supply competitors with capital.

A wrong conception of plant and equipment investment has been the reason of many a contractor's "going broke." The fact remains, however, that the Robert Simpson Company's contractor has been very successful in receiving preferential treatment and in securing contractors' plant at a nominal cost, thereby saving plant investment and freight charges.

It occurs to us to enquire whether duty was paid on the plans and specifications for this building when entering Canada. If not, WHY NOT?

Yours very truly,
CONTRACTOR.

Many Canadian Contractors Could Have Fulfilled the Requirements

Editor, The Contract Record:

From the viewpoint of the contractor it is regrettable that The Robert Simpson Company, in awarding the contract for the construction of their Regina branch, should have chosen a builder from the ranks of our U. S. competitors. The Canadian contractor suffers directly from the loss of work, and indirectly is injured in reputation. Naturally the public wonder why when they see a U. S. firm chosen for this work. At the present time a large contract would be a boon to any contractor.

To judge from your editorial, it would appear that from the first the Simpson Company had made up their mind to award the contract to a certain builder. For this we cannot blame them, if the business reasons for making such a choice outweighed the reasons for allowing a public competition, or for allowing a competition between a set of selected Canadian contractors and a set of U. S. contractors. Perhaps they were afraid of the unsavoury conditions which appear to exist in Winnipeg contracting circles, or perhaps the U. S. firm far underbid the local Canadian concerns who were so fortunate as to be large enough and of sufficient repute to be asked to figure on the work. U. S. contractors have a knack of underbidding Canadians. Labour costs more in the U. S., but I believe that unit costs are less. Canadian unit costs are fairly high.

Many U. S. firms that try a hand in Canada are not familiar with local conditions. Their experience is illustrated by what my esteemed friend John Quinlan, one of Montreal's best contractors, says. He will tell you that he has seen them "come in in the parlour car and go out in the caboose." Perhaps the apparent difference in the bids "looked good" to the Simpson Company, and they decided to keep the money for other purposes; or perhaps ———.

But why speculate? We cannot judge the Simpson Company justly until all the facts are disclosed by them, and such a frank disclosure is not at all likely to be made, nor is it to be expected.

As far as the Canadian workman is concerned, I doubt that he may be seriously injured. The U. S. contractor will not import an army of workmen: he will employ local labour as far as it is good, efficient, and productive; and he will pay standard wages, if I know anything about Unionism. He will buy local material when procurable and suitable, and he will supply the other materials as specified by the architects—and, by the way, who are the architects? The U. S. contractor will send his foremen and "supers" to Regina, where they will spend their money and be for the time being at least true immigrants. Should our competitor from over the border lose money on the job it is fair to assume that he would leave more money in Canada than he took out.

As a business proposition it is an old, old question. I have heard the matter discussed for years. It is the same problem as that of the large city contractor versus the village builder, which in itself is a matter of ill-feeling from one end of Canada to the other. In the days of our prosperity it did not matter so much. Now that the lean years are here it becomes a subject for debate.

For myself, I think it is unfortunate that this contract was not awarded to a Canadian. It is wrong if good Canadian contractors were not allowed, or asked, to bid on the work. At a time like this we need to help each other, and as far as possible to spare the keen cut of the sharp knife of business. The Simpson Company need us; we need the Simpson Company; and unless there be some good reasons for their not doing so, the Simpson Company should have awarded the contract to a Canadian firm. There are many good Canadian contractors—many in each province—and without doubt one of them could have fulfilled the requirements of the Simpson Company.

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*Of The Hamilton Bridge Works Company, Limited.

Yours truly,
A. F. BYERS.

Montreal, Aug. 30, 1915.

* * *

Do Canadian Contractors Tender on U. S. Department Stores?

Editor, The Contract Record:

We concur in the views expressed in your article relating to The Robert Simpson Company's proposed new building at Regina, and the award of the contract to a Chicago firm.

It is time some publicity was given to matters of this kind. One cannot help contrasting the action of the Simpson Company with the actions of the head of that firm's chief competitor—it is not necessary for us to mention his name. We feel quite sure that if it were necessary for him to build an addition to his stores, factories or warehouses he would not go to the United States to find a "competent" contractor to perform the work. It was not necessary for The Robert Simpson Company to go across the border, as there is an abundance of well-qualified and financially able contractors in Winnipeg and the West—men pre-eminently fitted to handle the work on account of their experience with soil conditions.

To our knowledge there have been three large contracts for buildings such as the one in question awarded this year in the Prairie Provinces. One, in which the undertaking was financed with French capital, was awarded to a Winnipeg firm; another, financed with U. S. capital, was awarded to another Winnipeg firm; and the one under discussion, financed with Canadian capital, was awarded to a U. S. firm. How consistent!

Would Marshall Field, or Siegel Cooper, or the heads of any U. S. Departmental stores, large or small, listen to a Canadian contractor if he went to Chicago or some other city for the purpose of tendering on the construction of renewals or additions to their stores or factories? There is but one answer, even in normal times. Why, then, should Canadians award their contracts to U. S. firms in such times as these?

We are informed by a reliable Regina contractor that even the local firms did not get a chance to tender on this work, and that apparently the contract was fixed for the Chicago firm. A bad feature of such awards is that preference is given to U. S. materials, and that in this way Canadian factories lose business—and by direct purchase the agent or middleman is deprived of his commission.

Your censure is well-deserved, and the matter should receive wide publicity.

Yours truly,
CHAS. CURTIS.[*]

Winnipeg, August 30, 1915.

Concrete is still frequently used in the most haphazard manner, proportions being given, and even specified, as 4 to 1, 6 to 1, 8 to 1 and so on. Ferro-Concrete thus calls attention to the subject:—"In the present day proportions of cement, sand and aggregate are almost invariably specified separately for important work, but it is to be feared that a good deal of concrete used in ordinary building construction is prepared on the hypothesis that gravel, and notably Thames ballast, consists of particles of sand and pebbles so mixed, naturally, that they are suitable for concrete, without separation and remixing in correct proportions to ensure the absence of voids in the final product. It is not sufficient to test the aggregate and sand for voids and then to decide upon the amount of cement. The first essential for really good and economical concrete is to grade the aggregate and the sand, so that each shall contain a minimum proportion of voids and provide a maximum amount of bearing surface for the particles of each constituent. The next thing is to determine the proportion of cement required to fill the whole of the voids and to coat all particles effectively. Last, but not least, the materials must be thoroughly mixed, preferably by machine, with a judiciously specified proportion of water."

The Longest Rack-Railroad in the World

A prime favourite among American tourists this year is the ascent of Pike's Peak, in Colorado. One train leaves the lower terminus late in the afternoon and reaches the summit in time to witness the glorious spectacle of the setting sun, and, spending the night at the Summit Hotel, one is able to view the equally enthralling dawn of another day. One of the most popular trips is the Sunrise Excursion, which, leaving the lower terminus at midnight, lands the travellers at the crest in time to see the sun creep over the eastern horizon. This special service has developed to such a degree that the entire equipment of the railway has to be impressed to cope with the crowds.

The road is only opened early in June, and its continuance depends on the severe snows which set in early in the fall. On the upper five miles there is frequently snow falling in July, and the road is occasionally blocked, as the snow packs very hard in the upper exposed regions. Clearing out the snow is a difficult operation, as there is no mechanical appliance which can cope with the frozen layers of snow and ice. Trenches are cut in the solid mass and blocks about nine feet square are transferred to a flat car. The train with a load of blocks runs back along the line until a ravine is reached. The blocks are then slid off the car and sent tumbling down the mountain side.

The rack-rail system in use comprises a rack made of Bessemer steel, with the teeth cut from the solid mass of metal. It is built up in lengths of 80 inches. The rack-track comprises two of these rails laid side by side centrally between the outer metals, and set about 1½ inches apart. The rack-rails are so laid that the joints of each length do not come in line, while the teeth of one is brought opposite the space between two teeth of the other. This secures an even bearing at all times, and is conducive to smooth travelling.

The railway measures a little over 30 miles in length, and the gradient is 844.8 feet per mile, the highest grade being 25 in 100. The sharpest curves are 16 degrees, that is, of a radius of 358 feet. A large portion of the rails and rack are anchored to the solid rock; 146 of these anchors are used throughout its entire length. The highest point on the mountain is 14,147 feet above sea level. The railroad is the longest rack-railroad in the world.

The pneumatic method of placing concrete was used successfully for converting the mix 2,805 ft. through a 6-in. pipe on the Mile Rock tunnel work at San Francisco. The compressor capacity installed was 1,200 cu. ft. a minute, and the receiver pressure was kept at about 115 lb. a sq. in. This is regarded as a record for long-distance work of this character.

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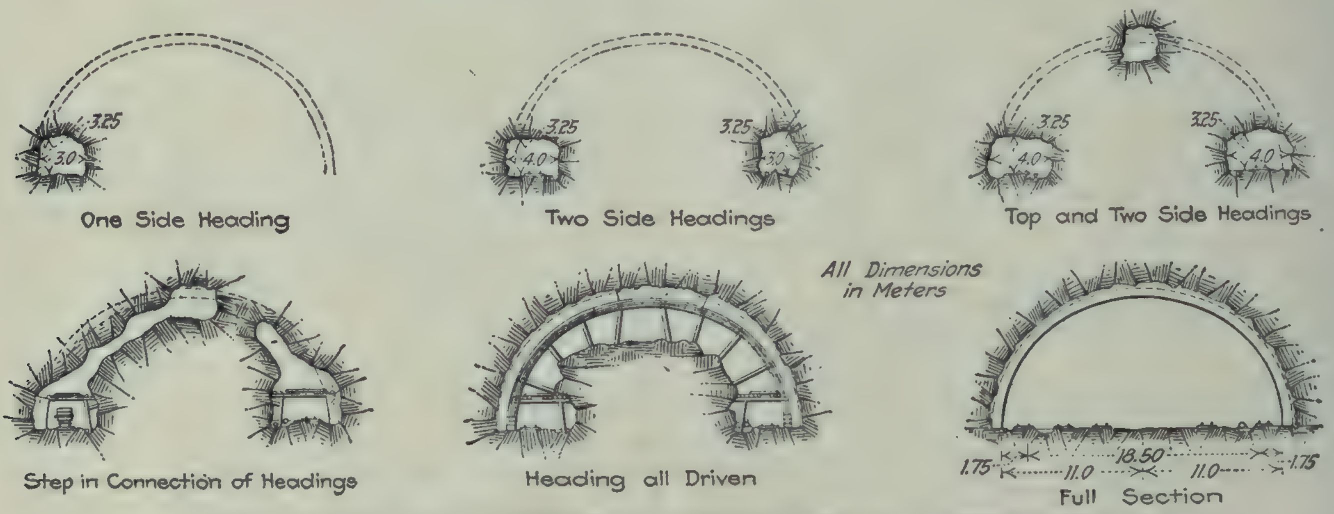
[*] Secretary, Richardson Builders, Limited, Winnipeg and Saskatoon.

The Largest Tunnel in the World

THE largest tunnel ever undertaken is that which has been partly driven at Marseilles, France, for the Marseilles-Rhone Canal. The tunnel is 72 ft. wide and the height from the bottom of the tunnel to the crown of the arch is about 40 ft. The total length when completed will be about four miles, and when its great cross-section is taken into consideration in connection with its length, the total volume of excavation will doubtless be greater than that of any tunnel for traffic purposes ever constructed. The total amount to be excavated is in the neighborhood of 2,500,000 cu. yd. Mr. E. L. Corthell, in the course of a visit to notable engineering works in the Mediterranean countries, examined this tunnel two years ago and gives a brief description of it in an article abstracted by Engineering News.

The accompanying drawings show cross-sections of the tunnel and the general method of construction. A part of Mr. Corthell's description of the work is as follows:



One Side Heading — Two Side Headings — Top and Two Side Headings

Step in Connection of Headings — Heading all Driven — Full Section

Cross-sections of rock tunnel on Marseilles-Rhone Canal, showing successive steps in excavating and lining.

We arrived at Marseilles on Feb. 22, 1915. Mr. Batard, Chief Engineer of the Port, and Mr. Bourgougnon, Chief Engineer of the Marseilles-Rhone Canal now under construction, were on the dock to meet us and take us first in Mr. Batard's sea-going launch about 15 mi. (8 km.) along the route of the new canal, the terminus of which is in the port of Marseilles, straight to the entrance of the tunnel now under construction through the rocky bridge that separates the Bay of Marseilles from the "Etang de Bolmon," and thence along the shores of the large "Etang de Berre," about 8 mi. (12.8 km.) in all, thence along the outlet of these lakes to the "Golfe de Foz," along the northern shore of that water direct to ancient Arles, following the latter part of the way the course of the Rhone.

The total length, Port of Marseilles to the Rhone at Arles, is somewhat less than 50 mi. (80.5 km.). It is built to bring the Rhone River traffic from Lyons and above direct to Marseilles. It is being built by the French government, with some assistance from the Chamber of Commerce of Marseilles. The large Rhone barges can then avoid the dangerous route of 25 mi. (40.2 km.) around Cape Couronne from the mouth of the Rhone, or rather from the mouth of the St. Louis Canal to Marseilles.

Before describing the tunnel, which is the principal feature of interest, let me say that the mouth of the Rhone has an interesting history. For centuries the question of improving it for the Rhone navigation had been a matter of study, projects and efforts, until the government started to build dikes to close the smaller outlets of the delta and two jetties at the principal mouth. But two serious errors were made, the jetties were too far apart and the methods of construction were too slow. The silt and sands protruded beyond the advancing jetties, always in advance, the bar moving outwards until, weary of "chasing a rainbow," it was decided to build a lateral canal (Canal St. Louis), about 3½ mi. (5.6 km.) long to debouch into the Gulf of Foz.

The disappointment and its causes are shown, with sketches, in my "History of the Mississippi Jetties," published by John Wiley & Sons in 1880. The conditions and historp were carefully examined by Captain Eads at the time of his visit to Europe in 1874 to learn the facts about many improved river mouths, to support his arguments for the bill then before Congress for improving the mouth of the Rhone as an argument in favour of the Fort St. Philip Canal from the Mississippi to Lake Borgne and against the jetty proposition. Now, the Canal St. Louis is to be practically abandoned and one 50 mi. (80.4 km.) long is to be built.

The tunnel is probably one of the most interesting rock tunnels ever undertaken in that it is, no doubt, the largest and one of the longest barge-canal tunnels in rock. The tunnel, lined throughout its nearly 4½ mi. (7.2 km.), is 22 m. (72.2 feet) wide inside the lining, and the crown of the arch (nearly semicircular) is 9.90 m. (32½ feet) high. The depth of water is to be 3 m. (10 feet). The plans illustrate the whole process of excavation, centering and lining, and are well worth the study of tunnel and canal engineers.

Briefly, as the detail plans are too extensive and numerous to be published entire, the process is as follows: A heading on the left at the base 3 x 3.25 m. (9.8 x 10.7 ft.), then one on the right at the same level and same size, then the enlargement of the two inward to give room for a track and ditch for drainage, then a small heading at the summit of the arch, then the enlargement upward of the two side headings to connect with the top heading, with a staging to receive the falling rock to be dropped into small dump-cars on the track, the permanent lining at the same time started on each side, then the enlargement of the excavation under the roof on both sides, which gives a chance to put in heavy centering on short posts, resting on the same mass core of unexcavated rock, then the masonry lining over the advancing centering completed, the centering then removed and carried forward and the bench removed.

The work is done by compressed air and it has the usual ventilating machinery and pipes, compressed-air pipes, drainage ditches, etc. The rock is quite varied in character: Dolomite of the Upper Jurassic, limestone, sequannian (above the Jurassic), and a mixture of the two. Suitable stone for the lining is found in the materials removed by the tunnel excavation. The contractor for the entire work is M. Chagnaud, who has recently completed the Loetschberg tunnel and approaches between Bern and the Simplon.

At the time the sections were taken which are here reproduced (July 1, 1912), the tunnel had been completed and lined for a distance of 600 meters and the advance headings were driven 500 meters farther. It is perhaps needless to say that work upon the tunnel, as on practically all other constructive engineering works in the belligerent countries of Europe, is now suspended.

It is doubtful whether it will ever be resumed. The vast burden of debt due to the war will prevent the European nations from embarking on the construction of any public works not absolutely necessary for a long time to come.

Apart from this, however, the proposition to build this enormous and enormously costly tunnel, merely to save a few miles of navigation in the open Mediterranean, would appear to be a scheme absolutely quixotic from the economic point of view. Probably the tunnel will take its place with other abandoned engineering dreams.

Wire Rope Clips Should Be Put On with Saddle Next Main Part

IN clamping the end of a wire rope around a thimble all the clips used should be put on with the saddle next the main part of the rope, says a writer in The Engineering Record. The obvious reason for this is that the saddle of the clip develops a much better grip on the rope than does the U-bolt. Most of the strain in a fastening of this kind is on the main part of the rope, and very little pull exists in the end part. If the saddle of the clip is clamped against the main part, the clip holds this part against sliding past the saddle and past the rough surface of the other part. If the clip is reversed, its grip on the main part of rope is reduced to the friction of the main part against the end part of the rope, and to the grip of the U-bolt on the main part. This grip is comparatively slight unless the clamp is tightened so much as to flatten the strands of the rope.

Users of wire rope have recently been advised of a convenient way of making an eye at the end of the rope. The length of the end beyond the center of the eye is determined by the number of clips required by the load, allowing several inches to each clip. This length is measured back from the end of the rope, and the round part of the thimble is tied to the rope at this point with wire. The rope is then bent around the thimble with another wire. The first clip put on is the one farthest from the eye. This is tightened, and the other clips required put on loosely. A strain is then taken on the rope, which equalizes the rope around the eye, before the remaining clips are tightened up. It is bad practice to tighten a clip entirely with one nut. This twists the grip of the clip on the cable, and is liable to bend the clip and make it worthless. The nuts should be screwed up a few turns at a time alternatively. After a rope has been in use a short while, it is necessary to go over all the clips and tighten them up. As strain on the rope pulls it out straight and slightly reduces its diameter, serious trouble has been caused by the clips becoming loose and slipping when this precaution has been neglected.

Fast Tunnel-Driving Records under the Bonus System

THE value of the bonus system of paying wages to secure rapid progress in driving tunnels is the subject of interesting editorial comment by The Engineering News. This system, says our contemporary, was tried successfully at five recently built tunnels, where high-speed records were attained. As it was the only important practice that was common to all these contracts, the records made can be attributed logically to the bonus system.

Deciding upon a reasonable base rate—that is, a rate of advance above which a bonus is to be paid—is the first essential step in applying this system to a job. Past performances and the law of continuity are the only accurate guides in arriving at a decision. A base rate may, in the light of altered conditions, become obviously unfair, in which case it should be changed. The bonus paid should not be excessive, but should be liberal enough to be one which doubles wages if the rate of progress is doubled.

The principal saving effected through the bonus system of paying wages comes through shortening the time of driving a long tunnel and thus reducing the interest charges on the work. The sooner it becomes operative, the sooner it will begin to earn an income. There is also a saving to the contractor in reduction of charges for interest and depreciation on his plant and bond and insurance payments; while the saving in labor per linear foot of tunnel driven is also considerable. There is very little difference in the cost of supplies, as this tends to be nearly constant per linear foot of tunnel.

The Mount Royal Tunnel Work

That men appreciate the opportunity to earn extra money is shown by the figures for the record month on the Mount Royal tunnel work at Montreal. The minimum or base rate was 14 ft. per day, making the total advance required in 31 days 434 ft. The rate of bonus was so proportioned that the men in the hole would just about double their wages if they doubled progress, no one outside of the tunnel participating in the bonus. The actual progress attained was 810 ft., which gave the workmen in the hole an 85 per cent. addition to their usual pay. The actual saving was only about 13 per cent. on the tunnel payroll, but was a saving of nearly 50 per cent. on the construction overhead, outside payrolls, interest, etc. Practically all the work on this contract was on a bonus basis.

An actual instance of the effect of the bonus system on the industry of the men is given by Mr. F. P. Brown, Chief Engineer of the Canadian Northern-Montreal Tunnel & Terminal Construction. Seven muckers were employed in the heading under normal conditions, three in advance throwing the muck back from under the bar and the four other men loading onto the cars direct. Mr. Brown says that normally a mucker thinks he is doing a good day's work when he shovels 7 cu. yd. of loose muck into a car, and that really this is all that can be expected of him. During the record month at the Mount Royal tunnel, however, the four muckers who were loading onto the cars handled up to 15 cu. yd. per man per shift, and averaged over 12 cu. yd. In order to appreciate that this is probably a mucking record, it must be remembered that nearly two hours were lost out of the eight in blasting, as two shots were fired regularly every shift. On this work a foreman never had to hire or discharge men during periods of rapid progress. If a man failed to do his share of the work, his comrades ran him out of the tunnel and brought in a better man to take his place.

In tunneling under the bonus system it is important to guard against a tendency toward carelessness on the part of the men in their endeavor to make high speeds. Where timbering is necessary, it should be regularly inspected.

Various Systems of Factory Building

THE architect about to plan a factory or works needs to give particular heed to instructions: for the whole building and occupants when complete constitute in truth a kind of machine, whereof the workers are the motile organs and the structure the framing wherein motion takes place. He should either very carefully study the particular methods of work or manufacture, or listen very attentively to the instructions of his clients. In work of this nature the planner is naturally very much under direct dictation by men having the special business "at their finger tips." Rightly, workers are under careful protection of the State, and, consequently, special Acts greatly affect planning. The whole proposition in factory planning is commercial; generally the greatest floor area for the least money. It is not so much what will look well, architecturally, but what will work well, facilitating maximum production at least cost, after duly satisfying all demands of central and local authorities and by-laws.

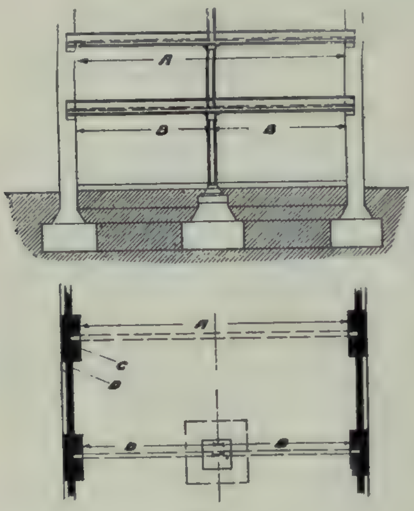


Fig. 1

The factory planning which is demanded of the architect is a maximum of works accommodation for money outlaid; the greatest area for practical work with the least obstruction; but the cutting down of total area of supports is not always in harmony with economy in first cost. Large spans add to expense of construction. To economize we need moderate spans and more supports, so that although the general demand is for as much unobstructed floor space as possible, unless it is considered worth while to secure floor-area free from obstructing pillars, the centre supports must be provided in harmony with basic principles of economical beam construction. In Fig. 1, to divide the span A into two parts, as B, will make a very considerable difference in the cost of steelwork, in the case of heavily loaded floors. As a rule, in factory planning, with multiple floors to carry heavy loads, increase of total support area, within reason, reduces costs, since large spans involve great increase of weight of metal in girders. Moreover, we should, if engaged on work immediately to be carried out, remember the trying times in which we now live. The building trade is depressed, business firms are, especially where engaged with constructional steel-work, operating under great difficulties, in part owing to the enormous demand for steel for war purposes. Plainly, we cannot bridge a great void with any kind of chance girder, but we may, where spans are moderate, and well within the outside size of stock rolled joists, find it possible to get some quite suitable section other than that we might in preference select. Thus, by a judicious reduction of span, considerably economizing in the first cost of the building, we not only save engineers' work at a time of extreme stress and pressure, but may get delivery of sections where others may be practically unobtainable. The designer of a building requiring much steel must at the present time keep quite an open mind as to the sections he will use. Bearing, too, on this question, is the matter of type of support, for while cast columns need patterns, since we can seldom hope to find anything of this nature suitable in stock, stanchion construction permits of cutting from stock lengths; and here, again, we may, in what is practically a famine time for steelwork, find, if not exactly the section preferred, something that will well answer the purpose. In architects' work at the present time the brightest field is perhaps factory and works construction and addition, so that it may be useful to point out how a little revision of details of proposed construction may facilitate progress with the work.

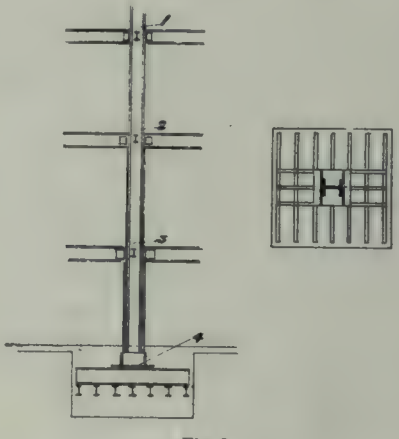


Fig. 2

The choice of general type of building construction rests between ordinary mixed brick and steel, Fig. 1, and B., Fig. 3, genuine steel-framed construction, Fig. 3, A., with more or less reinforced concrete and genuine en bloc ferro-concrete. A time like the present, with an extraordinary demand for steel and virtual congestion in every engineer's shop and shortage of skilled mechanics, should favour a system like ferro-concrete, employing little steel and that with little or no skilled labour. In weighing these matters the type of building must be considered. As a rule, concrete construction is not suitable for buildings of one storey, such as engineering shops, like Fig. 4, and munitions factories. When works are of the low, ground-floor type, such as for the industries mentioned and for motor-car factories, and when land is cheap and plentiful, first cost is best studied by building brick walls and providing steel roof trusses. The advantage of reinforced concrete construction is only apparent in buildings of several storeys. The cheapest and most quickly erected method of factory structure is that of light steel sections for vertical posts, light steel roofs and enclosure of sheet galvanized iron, such as has been often used for power houses and for miscellaneous industries, and this type is suitable where there is some urgency but not great enough to demand temporary wood framing. Various fireproof substitutes have of late years been produced as substitutes for galvanized iron which, under the best conditions, is very short-lived. Steel joists for posts spaced under each roof truss, with roofs of steel, north lighted, and with suitable roof covering and walling enclosure, offer the best and cheapest method where despatch in erection is important.

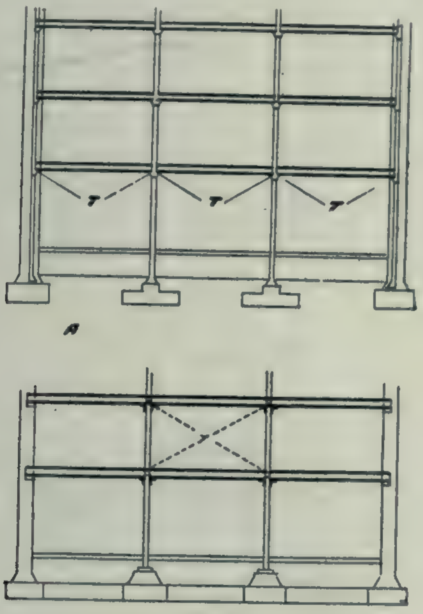


Fig. 3

Taking the ordinary substantial system of brick-walled factory and warehouse construction, this may be either with true steel skeleton or on the older method, where the girders bear on the main wall, as in Fig. 1. In this latter case, so long as a proportion of the facade is pier, as C, Fig. 1, the regulations admit of any suitable kind of screen walling, D, vertically between window openings. We cannot here do with less than 9 in. of brickwork, where some ferro-concrete designs cut down screen walls, i.e., filling in between weight-supporting piers to 2 in. For ordinary construction of two or three floors we need not employ steel-framing, i.e., the extra stanchions built into walls; but for factories piling up storey upon storey nothing is more suitable than genuine steel framing, Fig. 3, A, a system of building that gives a "tie" T, not present in the case of mixed construction. And it cannot be said that ferro-concrete is so suitable for very many storeys, if there are many posts, for the deduction from floor areas at the lower storeys becomes a serious matter. It is not yet shown that ferro-concrete is a nostrum—a remedy for all shortcomings in older building construction methods. The truth seems to be that for ferro-concrete the work requires to be suitable for certain special constructions, as for certain moderate-storied factories, where no doubt nothing is more satisfactory; and it seems certain that a plain shell of reinforced concrete may be put up in the neighbourhood of 4d. per cubic foot, even lower figures having been suggested. What the immediate future of en bloc ferro-concrete for works, factories, and warehouses may be is not easy to forecast. It is seldom that an innovation, apparently superseding all types, actually does so, but it takes its fitting place, competitive and older methods surviving. Neither the ancient bricks-and-mortar method, nor the modern steel structure, has been yet swept away. Rushed-up jobs and factories are often required in a fever of haste, and for such ferro-concrete is not suitable, for its ultimate strength is a matter of time, whereas we may load up girders and steel joists as soon as they are bolted in position and all ready below for taking up the load. There is always this obvious benefit in pure steel construction. Again, it should in fairness be noted that to compare the area required by a reinforced concrete pillar with a rolled steel stanchion of, say, H section, the area taken up by this latter is not the net metal or its cross section in square inches, but the rectangle of its flange by web and flange depth. Viewing matters in this light, the solid steel column is the greatest saver of valuable floor area.

For the attachment of brackets carrying power shafting, undoubted advantages and great convenience attend genuine steel-frame building. Where the factory is heavily equipped with machines and new ones frequently added the girders and stanchions may be anywhere drilled for new brackets. In the immediate future there would appear opportunity for all varieties of factory construction. Although we may not adopt ferro-concrete en bloc, yet the roofs, bressummers, stairs, and landings are often most suitably made of concrete, reinforced, and the success of the system of reinforcing has stimulated ingenuity in detail, and a stratum of steel netting, or a few steel rods, is now good practice where not long since we should have put an array of relatively heavy steel joisting. For

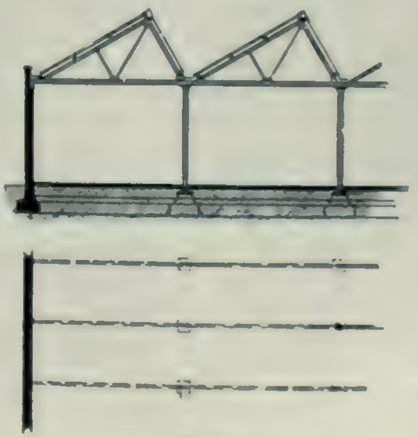


Fig. 4

fire-resisting warehouse and factory construction, simple steel reinforced concrete is highly suitable.

In London, the substantial factory building is an affair of brick-and-mortar exteriors, steel structure preferably being used as isolated points of support. In this class of work economy results from careful repetition, planning in equal bays and equal spans the work of construction required in the shops, and the work of the erection on the job being thereby considerably simplified; again, as tending to reduce the first cost of factory building, by using as many equal-sized, equal-section, similarly connected stanchions and joists as possible, thus securing expeditious machining and drilling prior to erection. Further, in the matter of stanchion design, the use of a similar section, such as a 10 in. by 6 in. R. S. J. consistently from the upper floor downwards, with extra riveted plates to give increased power as the load increases in the lower floors, as in Fig. 2, simplifies design and tends to keep down costs. At the present time, it may be that this practice, which has often been carried from basement through many storeys, may not be so conveniently practical as some diversity in sizes and sections. We had best take what we can get. Timber is dear, and steel-construction is hindered by the war. Those having immediate concern with works and factory buildings might do worse than first carefully ascertain how the war has affected steel constructional engineering, and find how, before designing and calculating, what are the most available sections.

The work of the designer of factory or warehouse for heavy loads, to be constructed with all regard to first cost, whether in concrete, steel, or of ordinary building construction, commences, or early necessitates, calculations for stresses and loads. The simplest procedure is to start from the roof and work downwards, bringing out the net weight of superimposed mass at the several points of support, as 1, 2, 3 in Fig. 2, at each floor level, finding the ultimate stress on the lowest stanchions (at 4), piers or columns, and so the pressure upon foundations at 5. In having all independent of brick and stone walling, the total load is the sum of that upon each lowermost stanchion, and for calculations such construction is the simplest. The whole load is the construction itself plus the legally imposed, or the "superimposed" load—as so many cwt. per super. foot. Economy is promoted by getting evenly-distributed loads upon stanchions and pillars. Very considerably more metal is required in steel props, not having balanced loading, or, in other words, not having equal stresses all round the axis of the prop. Not many architects trouble themselves with the details of steelwork in these days of close specialization; but there accrues a certain advantage in making a careful estimate of loads and stresses whilst plans are in embryo; for, if such plans be made finished drawings, the sizes of girders, joists, and stanchions or pillars will be correctly drawn from the first, and in the despatch and urgency with which such buildings will be erected, the draughtsman's work will be facilitated.

The weight calculations when brought to ground level give the load on brick piers or on stanchion baseplates (4, Fig. 2) and knowing, or assuming, the nature of the soil and its power to sustain weight, the area of concrete or grillage foundations (as Fig. 2) can be determined. Unless, therefore, we start away and determine all stresses from the time when the plans are settled and right for completion, we cannot do more than hazard suitable foundation design. In genuine steel-framed buildings a special importance attaches to stanchion foundations. The whole stability of such structures is based on unyielding points of support. If any point sinks, a series of eccentric stressing occurs which may be disastrous. The whole theory of homogeneous steel building construction is based on efficient "tie." We, and our forefathers, have so long in ordinary building construction completely ignored this that we may be apt to miss its importance where a great array of joists and stanchions is concerned.

If we have drawn out a works plan with sections, showing all accessory features, and have decided the thickness of walls in accordance with by-laws, the work of making these calculations may be commenced, and this needs reference to the controlling building Acts. The correct time for making these calculations is when the general plans are wholly approved by the client.

Masonry Dams

In building masonry dams for waterworks reservoirs the material should be made solid throughout. If rock is easily obtainable a good material is cyclopean rubble, or boulder concrete, formed with cement concrete in the proportion of one cement, two sand, and five stone. The foundation must be taken down to the solid rock and be free from all fissures or springs. Any water that may be found on the site of the dam should be picked up by pipes and carried to the outside of the wall as soon as conveniently may be, and if the soil on the upstream side of the dam is not water-tight a tongue trench, 6 ft. wide, should be formed along the toe of the dam. The cross-section required for a masonry dam is readily arrived at from well-known principles, by calculating the thrust of the water, which is a known amount according to the depth, and not, as in the case of retaining walls for earth, variable and impossible to be accurately estimated except by great experience; but, on the other hand, changes of temperature may set up considerable stresses in masonry dams. The line of thrust when drawn on the cross section should fall within its middle third, but at the same time consideration should be had to the pressure on the toe of the dam, and also on the outer face, to prevent overturning by crushing the material. The maximum compressive stress should not exceed ten or eleven tons per square foot, and, as an additional factor of safety, no allowance should be made for the tensile strength of the material on the inner face.

An instance of the damage done to the Emden by the Sydney's shots, states the Ironmonger, is to be found in one of the mementoes recently taken from the vessel. It is an oblong piece of metal, fairly smooth on one side, but on the other side presenting an appearance similar to that of a piece of jagged rock. It consists of a portion of the fireproof safe of the Emden and some silver dollars from a drawer of the safe. The explosion must have blown the dollars into the steel, and the heat of the flames which burst from the vessel shortly after the explosion melted the whole into a conglomerate mass of silver and steel. This gives a very clear indication of the conditions in those parts of the ship where the bombardment was most felt. It does not seem likely that much will be saved from those parts except for the melting pot or the foundry.

Vancouver Lodge of Eagles Occupy New Aerie

VANCOUVER Aerie No. 6, Fraternal Order of Eagles, are now occupying what is admitted to be the finest home possessed by any Vancouver fraternal association, with the possible exception of the Masonic Order. The new Aerie, which is located on Homer Street, between Pender and Dunsmuir Streets, was handed over by the contractors in the early spring, but considerable work remained to be done in the way of interior finish and decorating. The official opening is fixed for Labor Day, when Eagles from all parts of British Columbia, Washington, Idaho and Oregon will visit Vancouver for the occasion.

The building is of reinforced concrete construction, 50 x 120 ft., four storeys and basement. The front is finished on the ground floor with Toskeen Alaska marble, the upper portion being faced with composition white cement plaster, set off with ornamental work. A special feature on the front will be the figure of a big eagle, with spread of wings 12 feet. There will also be an eagle on the top of the flag-pole. The cost of these two eagles is over $500, and both will be gilded with pure gold. The ground floor and second floor are arranged for a tenant.

Vancouver Eagles' new building.

The two upper storeys are solely for lodge purposes. The third floor has offices for the secretary and lodge physician, rooms for an Eagle Club, with big billiard hall, reading room, etc. A small lodge hall, 28 x 39 ft., with ante-room, lockers, etc., will be used not only by the Eagles themselves, but also by other societies.

Besides these rooms there is a big separate dining room, with kitchen, pantry, etc. The fourth floor contains one of the biggest dancing halls in the city, this being 49 feet x 75 feet in dimensions. In connection there is a big cloak room, ladies' parlor, reception hall, smoke room, etc. All the halls and lodge rooms are finished in the most elaborate style, having ornamental wall plastering of special design, and beamed ceiling with ornamental cornices. A special feature in the building will be the heating, which will be the Dunham Vacuo Vapor Heating System, using the Fess Rotary Oil Burner.

There are two wide stairways, main and rear. The rear stairway is near the big hall on the fourth floor, leading directly to the big dining room on the third floor.

Mr. Emil Guenther, architect, of Vancouver, prepared the plans, and the Hosking Construction Company, Limited, Vancouver, were the contractors for the building.

Clay Foundations*

THIS paper opens with a reference to the difficulty to be anticipated in attempting to estimate the lateral pressure and resistances of clay, its constitution and properties being obscure. It is pointed out that the engineer would be content with a practical method of estimating the pressures and resistances exerted by clay, so far as these affect the design and stability of structures, but that published information is insufficient to aid him when confronted in practice with problems calling for a precise knowledge of the matter, and that the accepted theories of earth-pressure do not afford much assistance.

It is the purpose of the paper to bring forward a modification of Rankine's theory which, when applied to clay, yields results more closely in accordance with fact and observation. A short description is given of the monolith foundation work at Rosyth Dockyard, as it was in connection with this that the investigation which forms the subject of the paper was made. As the work proceeded, Rankine's formulae were applied to the different cases which arose, but the results were regarded rather as aids to practical judgment than as reliable solutions of the problem of stability. A search through all available records did not yield much information of value, although it revealed a high percentage of failures in work constructed in clay, and led to the conclusion that there was no available theory of earth-pressure which, when applied to clay, would command the general confidence of engineers. There were no fixed rules of practice, and there were grave differences of opinion as to what intensities of pressure could safely be placed upon clay foundations.

Experiments made with sand gave results closely in accordance with Rankine's law, and it was found that no kind of clay complied with this law. By diagrams and a simple mathematical proof the author shows where the plane of rupture occurs both in sand and in clay. Having determined the position of the plane of rupture in clay, he deduces formulae for the pressure and resistance of the clay. These are compared with Rankine's formulae in the subjoined table.

Formulae for the Pressure and Resistance of Clay

	Rankine.	Bell.
p_1 = intensity of active pressure on back of wall at any depth h	$w h\left(\frac{1-\sin\varphi}{1+\sin\varphi}\right)$	$w h \tan^2\left(\frac{\pi}{4}-\frac{\theta}{2}\right) - 2k \tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right)$
r_1 = maximum intensity of horizontal resistance of material in front of a wall at any depth d	$w d\left(\frac{1+\sin\varphi}{1-\sin\varphi}\right)$	$w d \tan^2\left(\frac{\pi}{4}+\frac{\theta}{2}\right) + 2k \tan\left(\frac{\pi}{4}+\frac{\theta}{2}\right)$
p_2 = minimum permissible intensity of downward pressure on foundation at heel of wall (depth H)	$w H$	$w H \tan^4\left(\frac{\pi}{4}-\frac{\theta}{2}\right) - 2k \tan^3\left(\frac{\pi}{4}-\frac{\theta}{2}\right)$ $- 2k \tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right)$
r_2 = maximum permissible intensity of downward pressure on foundation at toe of wall (depth D)	$w D\left(\frac{1+\sin\varphi}{1-\sin\varphi}\right)^2$	$w D \tan^4\left(\frac{\pi}{4}+\frac{\theta}{2}\right) + 2k \tan^3\left(\frac{\pi}{4}+\frac{\theta}{2}\right)$ $+ 2k \tan\left(\frac{\pi}{4}+\frac{\theta}{2}\right)$

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* The following is a synopsis of a paper entitled "The Lateral Pressure and Resistance of Clay, and the Supporting Power of Clay Foundations," read by **Mr. A. L. Bell, M. Inst. C. E. before the Institution of Civil Engineers.**

These formulae suffice for the design of retaining walls in clay, the surfaces being assumed to be horizontal. The theoretical work was supplemented by direct observations of pressure within a large mass of clay by means of four diaphragm gauges, used in the previous tests, and built into the side of one of the monoliths, being arranged in two pairs. Unfortunately one pair of gauges was spoiled by leakage, and owing to damage by blasting the records obtained from the other pair were insufficient to confirm completely the theoretical conclusions previously obtained. But so far as the records went they appeared to be in reasonable conformity with the theoretical position discussed in the paper.

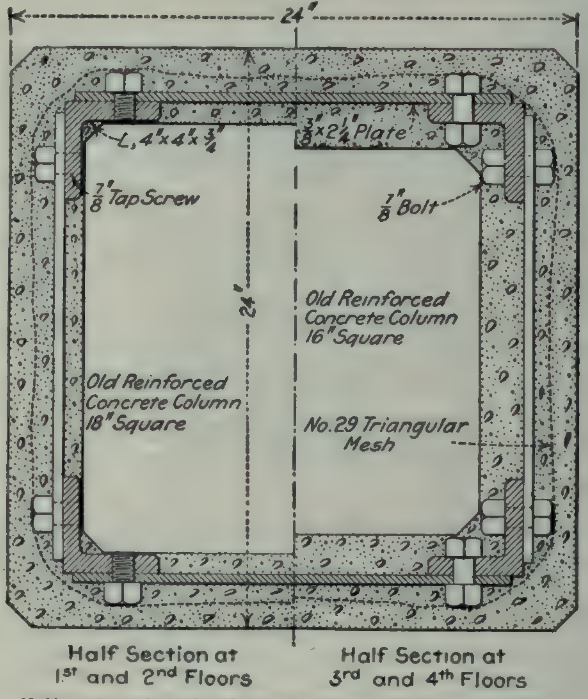
In conclusion, it is pointed out that it is not easy when designs are in progress to obtain clay in its virgin state and from considerable depths below the surface for the purpose of making tests; and in certain methods of construction the strata are often never seen in their normal condition, even when the works are in progress. Further, the building of a new work may have, in the course of years, the effect of altering the condition of the strata which press upon the structure. What the extent of these changes will be, and whether they will be beneficial to stability or otherwise, will never be determinable by purely mathematical methods. If reasonably correct results are to be obtained, some measure of judgment must lend its aid towards the solution of the real problems of earth-pressure which occur in practice, as distinguished from the simplified and somewhat unreal problems with which theorists necessarily deal.

A process of rust-proofing steel and iron is being promoted by Henry C. Baines, engineer and metallurgical chemist of Baines' Metallurgical-Chemical Laboratories, 411 First Street, Jackson, Mich. The process was developed in 1903, and several English factories were equipped for treating metal parts by it. The treatment consists of boiling the parts to be rust-proofed in a combination of chemicals for from fifty minutes to two hours, depending on the depth of rust-proof coating required and the size and bulk of the articles to be treated. The equipment required consists of an iron tank of a size necessary to accommodate the products to be treated, and a few utensils. The tank may be heated by steam or by any other heat. The cost of the treatment, including chemicals, heat and labour, is less than one cent a pound for small articles, averaging five to the pound, and the cost decreases in proportion to the increase of weight and bulk of the material treated. It is claimed that iron and steel, both wrought and cast, can be rendered permanently rust-resisting, and that it imparts a black matt finish to the metal, thus providing an attractive colouring and rust-proofing in one process. The treatment is well suited for articles to be painted, as it furnishes a ground impervious to rust and chemical action, and effectually prevents peeling of paint due to these causes.

A recent report made by the Provincial Government of Ontario shows that for the year ending March 31, 1914, there were 241 clayworking plants in the province, of which 25 were inactive. The value of the output of these plants in the period given was: Brick—common (kiln run), $3,283,894; paving and fancy, $243,119; pressed, $871,291; and sandlime, $459,699; sewer pipe, clay, $600,297; tile, clay drain, $251,705; total, $5,710,005.

Reinforcing Concrete Columns to Carry Additional Storeys*

It was necessary to resort to a somewhat unusual method of construction in the addition of two storeys on the machine shop of the Washburn-Crosby Co. mill in Minneapolis, Minn. This structure was one of the first reinforced-concrete buildings erected in that city and covers an area of 60 x 78 ft. It is five storeys high, has brick bearing-walls strengthened by brick pilasters and six interior reinforced-concrete columns. The floor construction is of the girder type, 6-in. slabs with two-way reinforcement. The wall footings went down to bedrock, about 9 ft. below grade, but no accurate data could be found regarding the size or depth of the six column footings. On figuring the old structure, the writer found that the concrete columns were not of sufficient strength to carry any additional storeys; they were actually too weak for their present requirements. Neither was the roof-slab, of course, strong enough to be utilized as a floor. In fact, the only parts of the building that would stand additional loading were the walls.


24"
L, 4"x4"x3/4"
3/8"x2 1/4" Plate
7/8" Tap Screw
7/8" Bolt
24"
Old Reinforced Concrete Column 16" Square
Old Reinforced Concrete Column 18" Square
No. 29 Triangular Mesh
Half Section at 1st and 2nd Floors
Half Section at 3rd and 4th Floors

Half sections through columns, showing method of reinforcing.

Another condition that added to the difficulty was that neither the continuous use of the elevator nor the lower four floors of the building could be interfered with, and as two floors were used for flour storage, it was essential to guard against leakage. Obviously the first step was to examine the column footings, to see whether they rested on bedrock and were of sufficient size to carry the additional load. They were uncovered, and five of them were found to go down to the limestone ledge, while the sixth one rested on a layer of shale about 18 in. thick. To secure solid bearing this footing was "plugged" in sections of about 1-ft. width and in that way carried to the ledge. All of them were in good condition and of ample size.

As the old concrete columns could not be utilized, it was decided to transmit the load of the new storeys to the footings by means of structural-steel members built around the old columns. Four holes were cut in the floor-slabs at each column and 4 x 4 x ¾-in. angles lowered down from the roof to the footings. They rested on a structural-steel base, made in two parts and bolted together. The angles were connected by ⅜ x 2¼-in. straps every 6 in. alterating, ⅞-in. tap-screws being used for connections at the two lower floors, where the original colomns were 18 in. square, and bolts on the upper two floors, where the old columns were 2 in. smaller. After the angles were connected up, No. 9 triangular mesh was wrapped around them and the concrete for fire-protection poured, one floor at a time. The finished columns were 2 ft. square, an increase of 6 in. over the old ones.

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*By P. R. Prufert, Engineer, John Wunder Co., building contractors, Minneapolis, Minn., in The Engineering News.

The old roof-slab and the fifth-storey columns were then wrecked, structural-steel caps bolted to the tops of the angles and the columns for the new superstructure poured on these.

The new floors were of flat-slab construction, without drops or column heads. Three weeks after the old roof-slab was wrecked, the new one was poured, and not a single sack of flour had been spoiled although the rainfall had been considerable during that period and stopped construction for several days.

Cost, Appearance and Wearing Qualities of Various Methods of Surface Finish for Concrete

(Concluded from last issue.)

R. H. Ford, Engineer Track Elevation, Rock Island Lines

(1) (a) Painting concrete placed in cold weather with a 1:1 cement and sand grout, mixed with water to a creamy fluid.

(b) Thoroughly wetting the concrete face and rubbing with carborundum brick.

(2) To fill visible voids and give uniform surface.

(3) Costs taken from actual cost sheets, where the record has been carefully kept and given per hundred square feet. (Form asks for cost per square foot.)

By method (a): Material, 2c.; labor, 38c.; total, 40c.

By method (b): Material and supplies, 2c.; labor, $3.00; total, $3.02.

(4) (a) We are making an extended investigation of the best and cheapest method of finishing concrete, and the answer to this question must be considered tentative. So far, however, I am strongly in favor of the rubbing. The item of expense can be reduced immeasurably by the application of power. The prices given above are based entirely upon manual labor.

(b) Our investigations so far are not sufficient to determine this question. It is my opinion, however, based upon information which we have, that painting is, as a rule, undesirable. We have been very successful, however, on some work that was done two years ago with this method. I attributed it, however, to the fact that the surface was rough and porous, and that the painting was done while the concrete was comparatively green. I do not believe in treating it with acid.

I believe that there is a large field for investigation in this particular line.

(5) I do not think that finished concrete (in the sense above used) is more susceptible to discolorations than unfinished concrete, although it may have that appearance. This, however, I think, is due to the fact that the contract is much more sharp on the finished work than on the unfinished.

The above information is based upon our investigations and studies of the work that this company is doing on track elevation in Chicago, extending over the past 14 years, and compared with an enormous amount of similar work being done by all other roads for the last 10 years. A critical analysis, however, is being made on all work of this character, which is now being done by the Rock Island Co., as unusual opportunity is now afforded for these studies from the fact that the matter is entirely within the hands of the railway company, both in design and execution."

L. D. Hadwen, Engineer of Masonry Construction, C., M. & St. P. Ry.

(1) We have used, in addition to the ordinary surface obtained by spading, a surface finish obtained by using a sand blast, as was done at Columbus depot.

A treatment of the surface with dilute acid to remove the surface mortar, as was done in the Missoula depot foundation.

A brushed surface to remove the mortar and show the rough aggregate.

Removal of the mortar skin by bush-hammering.

Treatment of the mortar surface obtained by spading, chiseling off board marks and rubbing the entire surface with emery.

A special mortar surface was formerly obtained by the use of a steel gage with angle-irons fixed to create a space about 1½ in. deep between the form surface and the body of the concrete. This space was filled in with mortar and the gage removed. This method is unnecessary, as an equally good mortar surface can be obtained by spading the aggregate back. The use of this practice, in order to place specially prepared material of different composition from the balance of the concrete to form a special surface for the finish, is undesirable, and there is danger of the surface material being of different composition from the balance, eventually checking and losing its bond with the body of the wall.

In building the Miles City depot foundation, the forms were lined with building paper with a view to getting a smooth finish, free from all board marks. The wrinkling of this paper caused a wavy finish and the surface approximating that of bridge stone, but this, in my estimation, has produced a freak appearance and is not a desirable finish.

Whitewashing surfaces with a liquid grout, or with a cement wash, is contrary to our practice and undesirable. It is only a matter of time before any such wash will check and scale.

Some experiments have been made with coloring matter, both lampblack and ochre, with the idea of getting a surface of a definite tint. The addition of any coloring ingredient to an aggregate is to be deprecated, because it is very difficult to insure uniformity in the mixture, and the result is liable to be a surface that is blotchy.

(2) The general object on most structures is to obtain a uniform surface with a dense coat impervious to moisture, and as good results as any can be obtained by careful spading without any special treatment of the surface. For wearing surfaces, such as floors with

heavy trucking, the use of special aggregate may be desirable. On some of our shop floors, granite screenings have been used for this purpose to give a granitoid surface. We have also used finely divided iron in some experimental sections of freight house, and a hard-wearing surface seems to be obtainable by incorporating such material or other patented preparations in the wearing coat. Except where especially dustless floors are desired, it does not appear necessary to go to additional expense for this purpose.

(3) It is difficult to separate the actual cost of finishing the concrete surface from the balance of the cost of concreting, but the cost of tooling the board cracks and rubbing down a concrete surface on ordinary subway work, using emery, will run about ½c. per square foot. The cost of sand blasting depends on whether there is enough work to justify the installation of a plant, and at Columbus was about 2c. per square foot.

(4) The best manner of finishing a concrete structure, in my estimation, is to use an ordinary spaced surface, and where special finished work is desired, is to use special care in the construction of the forms to get close joints and true surfaces, and after the removal of the forms to go over the work and chisel off any joint marks and then rub down the surface with emery to secure uniform tint. Where appearance is important concrete structures should be designed with panels to break up the large dead surfaces; the use of delicate mouldings and ornamentation should be avoided.

(5) In general, the smooth, natural surface of concrete will be less liable to discoloration than any form of treated surface.

(6) A great deal of effort is often made to remove board marks and the marks in the grain of the wood on finished concrete structures. To me the appearance of slight marking from the boards is more pleasing than the dead surface wrich shows absolutely no joints. This is noticeable where an opportunity occurs of comparing work built with steel forms and work built with wooden forms, the latter being less lifeless in appearance. The treatment of a concrete surface should not give the impression that it is an effort to conceal the mode of construction of the work.

William Hunter, Chief Engineer, Philadelphia & Reading Railway

(1) The following methods have been used: (a) Plain spaced face; (b) washed surface, with face coating of (1) pebbles, (2) granite or trap rock grit: (c) patent hammered surface, with face coating of granite or trap rock grit; (d) sand-blasted surface, with face coating of granite or trap rock grit; (e) use of metal-lined forms. In all of the above we have used a system of horizontal scoring to break the surface and to make a line designating the end of the day's work. The specifications for the above follow:

(a) Spaded Face.—All other showing surfaces shall be prepared by keeping the stone well back from the face, as the concrete is placed, by "spading," thus bringing the mortar against the face. After the forms are removed, the surfaces shall be pointed where necessary, and washed with neat cement applied with a brush. Plastering the face after removing the forms shall not be permitted.

(b) Washed Surfaces.—Washed surfaces shall be composed of 1 part cement, 2 parts coarse sand or gravel and 2 parts granolithic grit, made into a stiff mortar. Granolithic grit shall be granite or trap rock crushed to pass ¼-in. sieve and screened of dust. For vertical surfaces the mixture shall be deposited against the face forms to a least thickness of 1 in., by skilled workmen, as the placing of the concrete proceeds, and thus form a part of the body of the work. Care shall be taken to prevent the occurrence of air spaces or voids in the surface. The face forms shall be removed as soon as the concrete has sufficiently hardened and any voids that may appear shall be filled up with the mixture.

The surface shall then be immediately washed with water until the grit is exposed and rinsed clean and protected from the sun and kept moist for 3 days. For horizontal surfaces the granolithic mixture shall be deposited on the concrete to a least thickness of 1½ in. immediately after the concrete has been tamped and before it has set, and shall be troweled to an even surface, and after it has set sufficiently hard, shall be washed until the grit is exposed.

All concrete surfaces exposed to the street shall be marked off into courses in such detailed manner as may be directed by the Chief Engineer.

The same specification applies to the use of selected pebbles.

(c) Patent Hammered.—Showing faces of concrete shall have a granolithic finish, prepared by depositing with the concrete, a front surface of at least 1 in. in thickness, composed of 1 part cement, 2 parts sand and 2 parts clean granite or trap rock grit. The surface shall be scored and patent hammered; when exposed to running water, floating ice, etc., the face coating shall be 2 in. thick.

(d) A sand blast surface is prepared as in "c," and the sand blast is used in place of the patent hammer to give a surface finish. This has not proved successful in our experience, as it is very difficut to obtain a uniform surface.

(e) Metal Lined Face.—The same specification for the granolithic grit, as in "b," excepting that no washing is done, and upon the removal of the forms, the imperfections of the surface are touched up.

(2) The object desired is to have the surface presentable and uniform in color, as well as durable. A reasonable score breaks up a large surface, hides construction marks and the washing or other treatment, because uniform in color and texture.

(3) It has been our experience that the cost of patent hammering varies from 5 to 7c. per square foot. We have had no contract prices on the question of washing, but our experience would indicate an increase in price over the plain spaded work of about 25c. per cubic yard. We have no figure which would show the cost per superficial foot for this class of work.

(4) The best manner of finishing concrete structures depends on conditions in which the location of the construction plays a very important part. For structures which are not readily seen, it would be ill-advised to use any other than a spaded surface, or such surface as can be obtained by the use of metal-lined forms. If, however, the work is in such a location as to be readily visible, and exposed to the public, we believe that the best for really satisfactory results is by the use of a granolithic surface, scored and patent hammered, or a face coating of pebbles, washed and scored.

Jos. O. Osgood, Chief Engineer, Central Railroad of New Jersey

(1) At the time of depositing the concrete, the surfaces to be exposed are thoroughly spaded next to the forms and the coarser aggregate worked back in the concrete, leaving a surface of cement mortar next to the forms. After the concrete has sufficiently hardened, the forms are removed. The surface to be finished is then thoroughly wet with a brush and rubbed

with a coarse carborundum brick, forming a lather. This process is continued until the form marks are sufficiently removed. The lather is then washed off and the concrete surface again wet. A float finish is then applied with a brush consisting of a liquid grout of the same mixture as the concrete and rubbed into the face with a wooden float. In many cases where it is only desirable to remove the form marks, the liquid grout finish is omitted.

(2) The surface obtained by the use of carborunhum stone is comparatively smooth and even colored and form marks are indistinguishable from a short distance. The floated finish of grout develops a surface with a sanded appearance. Both of the above surfaces weather satisfactorily and are used extensively for the finish of piers and abutments of bridges where the surface finish is not subjected to close inspection.

(3) The cost of the above finishes depends upon the amount of scaffolding necessary, including scaffolding and supervision; the cost runs from 1 to 3c. for the rubbing with carborundum stone. Including the float finish, the cost is from 2 to 4c. per souare foot.

(4) In structures where the appearance of the surface of the concrete is not important and it is not necessary to provide decorative features, the above methods are satisfactory. It is practical, however, to remove all of the form marks by these methods, and if this is desired, some other method of treating the surfaces should be used, preferably tooling. We do not believe that the surfaces should be treated with acid.

(5) Surfaces of concrete which have been treated by any process, by means of which the surface is roughened and the aggregate exposed, soon present a very dirty appearance, due to the collection of dust on the projections. For outdoor structures, a smooth finish of concrete presents a much neater appearance.

Arthur Ridgway, Assistant Chief Engineer, D. & R. G. R. R.

(1) In our own work we have made use of but three methods of finishing, viz.: (a) Leaving the natural surface made by the forms; (b) rubbing down the surface with carborundum blocks; (c) rough cast finish made by throwing various mixtures of cement and aggregate on to the surface.

(2) Aside from aesthetic considerations, there would be no object in making any change in surface left by forms (except waterproofing or wearing qualities), as I believe that finish to be the most durable and satisfactory from a practical standpoint. Of course, in the case of horizontal surfaces, to stand abrasive action, a coat of mortar can be applied to surface before the mass sets, with satisfactory results.

In case of other surface work, which had been poured in forms and set, we should not attempt to apply a trowel coat if it could be avoided, but have sometimes gone over an imperfect surface with a coat of mortar and immediately scraped all material from surface, leaving voids filled.

We have arrived at the conclusion that, even from the point of view of appearance, about the best results are obtained by spending the money available in careful workmanship in erecting forms and thorough spading of the concrete against them. It is a perfectly natural way to use the material at hand, and in accordance with accepted principles of design should give artistic results. We have made some efforts to so arrange the joints in forms as to give character and design to the resulting lines left on the structure. This would apply, of course, to the larger masses, such as bridge abutments, portals of tunnels, etc.

We have only tried rubbing down the surface in one case, and results were not satisfactory, so that only a portion of the work was completed. The forms were rather well fitted and I think that the natural surface is more satisfactory in this case. We use the dash coat on plastered surfaces, such as depot and other walls, and it is satisfactory on account of appearance, stability, resistance to defacement by marking with cravons, and because cracks are not so apparent on a surface of this texture.

(3) It would be hard to say as to cost of producing a good surface by careful form building and spading, but it is obvious that better results can be obtained at less cost than by other methods. The cost of rubbing down with abrasives would hardly be less than 5c. per square foot at the time forms would ordinarily be removed. The cost of a dash coat should not be more than 15 to 25c. per square yard aside from scaffolding.

(4) Strictly, we think the best method is the natural surface, as stated above. It may be that the material is not adapted for use as a finish where great reinforcement in detail is desired, but much depends on the experience and intelligence of the mechanics employed in any particular case. Surfaces having a fine, smooth finish are not durable on account of surface shrinkage of the material and consequent hair cracks. This has been overcome by prolonged and careful tempering of the finish coat, but the process is as yet not generally understood.

Some good results have been obtained by tooling and acid treatment, but at a considerable cost and great care in selection of aggregate.

Good results have been obtained by careful mixing of a fine screened lime or other stone with a small amount of cement of such consistency that the screenings show against the forms, as in several neighborhood houses in south parks in Chicago.

(5) There is no question that removing the natural surface of any concrete renders it more porous and, therefore, more susceptible to discoloration from smoke, etc., though this depends to some extent on character and richness of the mixture.

(6) In general, ordinary mass and reinforced concrete used on railway structures can be made to satisfy all reasonable practical and aesthetic considerations with little other work than the careful building of forms and proper attention to placing the material. One advantage of this work is that it is now generally understood by mechanics and can be obtained anywhere without undue attention or high-class supervision, which cannot be said of the more complicated methods of treatment.

A comprehensive scheme is on foot for erecting a large exhibition building or "Palace of Industry" for the holding of trade exhibitions in the London area, and in particular for a large industrial fair in the spring of 1917. Already a site of 44 acres has been acquired at Willesden Green alongside the Metropolitan Railway, and a building of 500,000 square feet area will shortly be commenced. It is proposed that the profits of the exhibition be distributed among the firms participating in proportion to the space occupied by them, and the management is anxious to get into touch with the trade associations and societies in the country which are not already represented on the Advisory Council.

Artificial Illumination in Relation to Architectural Effects

IN a paper on the above subject presented recently in London at a meeting of the Society of Architects the author, Mr. S. D. Chalmers, M.A., Head of the Department of Technical Optics, Northampton Institute, said that progress in the practice of artificial illumination had provided architects with new materials and resources for producing architectural effects, particularly in relation to the interiors of buildings and the decoration of halls and small rooms.

It was true that the illuminating engineer had as yet made little progress in the application of his new methods to these purely architectural problems; it was only natural that he should first turn his attention to the more utilitarian aspects of artificial lighting. His aim had been to produce the illumination requisite for the comfortable use of a room for its ordinary purposes; and economy had been one of his prime considerations.

He had, to a very considerable extent, solved the problem of the efficient and economical distribution of the light available. He avoided excessive illumination of any point, and by screening his sources of light reduced the glare, and so was able to obtain the same visual effects with reduced actual illumination. He took into account the reflection co-efficient of his walls and ceilings, the nature of the objects to be illuminated, and the fineness of detail which must be distinguishable.

Decoration in its Relation to Lighting

It was not always possible to make effective use of artificial light in buildings and rooms which had been designed entirely with a view to their effect in daylight. Just as the architect considered the site and lighting of his building in regard to its outside form and its interior decoration, so he should consider the scheme of interior decorations in relation to the artificial lightings with which it would be used.

Some types of decoration were quite unsuitable for artificial illumination and should be avoided in rooms which were intended to be used almost exclusively in artificial light. Other types were suitable for either illuminant. But the differences between the characteristics of daylight and artificial illumination were such that one could not assume that good results would be obtained by artificial light, even though the results by daylight were most satisfactory.

The great contrast between the Classic and Gothic styles was closely associated with the variation of the lighting conditions. In Greece the conditions were simple—a bright source of light almost always available, and a relatively small amount of diffused light. In the sunlight clear-cut shadows were produced, and only shallow mouldings were necessary to secure the necessary contrasts of light and shade. This was well illustrated in the columns of the Parthenon, where the sharply undercut mouldings produced clear, sharp bands of shadow.

But when buildings in the Classic style were erected in climates like our own the quality of the light was different, and the features must be modified if the same effect was to be produced; and the proportion of diffused light being greater, it was necessary to deepen the flutings to produce sufficient contrast. This same general characteristic was noticeable in artificial illumination when one bright source was replaced by a number of small ones.

It was this same effect of deeper mouldings and flutings that marked the Gothic as contrasted with the Classic architecture, and once more it was the lighting conditions which determined the extent of the change; the more diffused the light, the deeper must be the moulding.

These same general principles applied also to interior ornament. The more diffuse and less direct the lighting, the more was it necessary to intensify the mouldings, carvings and other relief. When the lighting came from above in a comparatively narrow beam, the ornament must be in low relief, while a general diffused lighting from in front was more suitable for cases of deeper relief. An illustration of this principle was furnished by the Miserare seats, with the low relief above and the deep relief below.

In most cases of artificial lighting, ornaments on the level of the lights might be in deeper relief than those well above or below. In the same way it was unwise to illuminate a ceiling with deep mouldings by lights placed too close to the ceiling, as this resulted in long and deep shadows.

When the lighting was very diffuse, it was sometimes preferable to produce the impression of depth by special devices, such as the linen-fold panel of the English and Flemish architecture of the fifteenth century. Such devices were usually suitable for artificial as well as natural lighting.

Turning to the possibilities of the artificial illumination of interiors, the author said that the conditions were in some respects less, and in others more, favourable than those of natural lighting. The daylight usually came as diffused light from a comparatively large window area, producing very variable illumination throughout tre room. It was exceedingly difficult to modify its distribution to any appreciable extent, and the amount was very variable throughout the day and year.

On the other hand, the eye adapted itself very readily to the variations of daylight, ignoring all excessive contrast and accepting the variations in colour of the light without noticing them. Not the smallest advantage, perhaps, was that the actual source of light did not come into view, and it was not necessary to devise special methods of screening it.

In the case of artificial illumination the original sources were comparatively small bright objects which obtruded themselves most unpleasantly if we omitted to screen them from direct view. But because the sources were small we could surround them by diffusing screens or reflectors and materially modify the distribution of the light coming from each source.

With modern, properly designed reflectors it was possible to produce almost any desired distribution of the light, from practical uniformity to concentration in comparatively small angles in any desired direction. By the judicious placing of the sources of light and the proper choice of reflectors we could obtain almost any desired distribution of the light with one limitation, that the light coming from each individual source to any point would be coming in a comparatively small angle. Each source would tend to produce well marked, deep shadows, and care must be taken that the effects of the other sources were to reduce the depth and size of these shadows to the desired amount. In this way the shadows might be made architecturally useful rather than the reverse.

It was this possibility of varying the character of the lighting and the change in the distribution almost at will that made it possible to obtain different architectural effects. The ideal of the illuminating engineer had generally been to produce even and soft illumination throughout the room.

But it seemed to the author that this was not always the most suitable lighting, and that in some cases a more one-sided lighting, with a subsidiary cross or reverse lighting, might be usefully employed. In using this method, however, one must not try to imitate the conditions of daylight too closely. The variations must be considerably less than those of daylight, because the actual illumination would usually be considerably below that which prevailed with daylight, and at this lower illumination the variation was much more readily appreciated.

This effect is not materially altered by actually increasing the illumination by artificial light, because of the dazzling effect of intense artificial light. Owing to the adaptation of the eye to the conditions prevailing in artificial illumination, comparatively small variations were effective, and it was unwise to produce strong contrasts between the different parts of the room.

Most people found it unpleasant to sit in a well-lighted part of a room while the rest was in comparative darkness. It was on account of this adapt condition of the eye that it was so important to screen the modern sources of high intrinsic brilliancy, and the only effective way was to make the light appear to come from an area much larger than that of the source. The smallness of the size of artificial sources was troublesome when reflecting surfaces, such as varnished wood, was present, and in some cases the reflections were objectionable. They might be reduced by increasing the size of the source or altering its position.

The same difficulty of reflection occurred in connection with picture lighting, and care should always be taken to place the sources sufficiently above the picture to make the reflection invisible at the ordinary level of the eye. This generally added to the difficulty of securing even illumination on the picture, but by properly distributing the light from the source almost any required degree of evenness of illumination could be obtained.

Still further difficulties were encountered in regard to coloured ornamentations, and these troubles were accentuated if the illumination on the coloured object was low. The relative brightness of the parts of different colours would change as the illumination was dismissed, and it was a wise precaution to secure abundance of light for any coloured ornamentation.

Even with this precaution, the colour values were unlikely to be exactly the same as with daylight, though the recent attempts to improve the colour rendering by artificial light had met with considerable success. But the rendering of variations of shade in a flat object was almost the same by artificial light as by daylight, and the same might be said of pierced work where the contrast of a carving was enhanced by piercing.

Pierced screens were interesting, as showing one of the earliest methods of combining natural with artificial lighting effects. In daylight the screen was lit from in front, the openings appearing dark to contrast with the screen; when the altar was lit up the screen was seen in silhouette, and the piercings light.

Diffused Lighting

But there were other methods of artificial lighting to which the author referred. In these methods attempts had been made to imitate the conditions of daylight lighting. An example was the use of a group of lights surrounded by large diffusing screens or reflectors, in imitation of the method of the oculus as used in the lighting of the Pantheon. It was easy in special cases to imitate the effect of this method of daylight lighting, and the method was applicable in large halls or theatres. But the method of indirect lighting approached most directly to the effects of daylight.

In this method the light from the source was sent on to a white ceiling or screen and was directed downwards to illuminate the room. The absence of marked shadows rendered this method useful for certain purposes, as, for example, the lighting of drawing-offices; but unless the illumination was very high the method gave the impression of a poor imitation of daylight, suggesting coldness and wintriness. We interpreted this artificial lighting in terms of daylight and the suggestions that this daylight carried with it.

It was probably on this account that many people preferred the semi-indirect system of lighting, in which part of the light from the source was allowed to pass through the shade, while the other part illuminated the ceiling. In this case the impression of artificial lighting was retained, and the comparison with daylight did not obtrude itself; at the same time the conditions of shadow were more those of daylight, and the indirect light from the ceiling tended to soften the whole lighting. This method of semi-indirect lighting was specially useful when the ceiling and frieze were worthy of attention in themselves, as, for example, in beautiful moulded ceilings.

In all these cases of indirect lighting it seemed preferable to show sources which illuminated the ceiling even if the greater part of the light be really derived from concealed sources.

There were, however, a number of cases in London where the ceiling had been lit entirely by means of concealed lights, and the effect had not been happy. These lights produced beautifully even lighting on the ceiling, but one unconsciously asked where the light came from, and the only explanation was that there must be an opening between the walls and the ceiling, and apparently it must extend all round, there being no distinctive direction in which the light came, and ceilings which are unsupported are uncanny. In one of these cases the effect was much improved by the use of a number of visible sources which apparently illuminated the ceiling.

Thus, as regards interior illumination, the conditions were somewhat different for artificial and natural lighting. But each had its advantages, and by judiciously using the resources of artificial lighting it should be possible to obtain quite as good results as with natural lighting, but this was a matter for the architect as well as the illuminating engineer. New methods and arrangements of lighting were required.

In cases where rooms were to be used only or mainly by artificial light, the architectural features should be designed in relation to the actual method of lighting to be employed. When few but large sources of light were to be used, the conditions approximate to outside natural illumination, and models of ornament and architecture might well be sought in Classical types; but when numerous smaller sources were to be used, the conditions approximate more to the Gothic conditions, and mouldings and ornamentation of that style might well be studied in connection with their value in artificial light.

As to the illumination of the exterior architectural features of a building, when the aspect was a southern one, the same condition as in daylight might be approximated to by the use of one large source of light high up in front of the building, and a number of smaller sources placed lower down and distributed along the length of the building.

When the aspect was a northerly one, the whole lighting should be by a number of small sources evenly distributed in front of the whole building. Occasionally friezes could be well lit by concealed lights above the frieze, the proper distribution of the light being secured by the use of suitably-designed reflectors. In this case, again, the difference between the treatment of high and low relief was important, and the effect of the high relief was even more exaggerated for statues or very deep mouldings, which required front rather than high lighting.

The Canadian National Exhibition

The great Exhibition which is held at Toronto each year during the first two weeks in September has become in its every aspect a national event in the life of the country. It is an exhibition in the greatest sense of the word, for it shows the country at its best in every line of activity. For years the Toronto Exhibition has become synonymous with progress, and nowhere is this demonstrated to greater advantage than in the constructional field. No apology is needed, then, for the space devoted to a brief mention of some of the exhibits. It is hoped that manufacturers and others will avail themselves of the invitation extended below to furnish supplementary information about their exhibits and—where possible—photographs of them.

THE Thirty-Seventh Annual Exhibition of the Canadian National Exhibition Association, now in progress (Toronto: August 30 to September 11), is remarkable in many ways, but in none more so than in the manner in which it demonstrates the clear conviction of a large section of the general public, as well as of the manufacturing interests of the country, that there is something in the "business-as-usual" sentiment after all. It is a great and glorious contradiction of the doleful assertion that "nothing remains but the war"—a subject discussed editorially in this issue; it is a standing monument to the enterprise and faith of those who believe that Canada has not only a great destiny to fulfil **after** the war, but much useful work to achieve **during** the war.

The records of attendance alone, which to date have easily eclipsed those of last year, are material and striking proof of the support which the country gives to an institution which is coming to be regarded as the greatest annual Fair in the world.

In making the round of the constructional exhibits The Contract Record has been cheered by many optimistic reports. No extravagant statements have been forthcoming, but sufficient has been said to indicate that on the whole the inquiries received have been satisfactory and even gratifying. Nothing more could be expected, having in mind the reduced volume of business transacted of late.

One might describe the scope of Toronto's great Fair as all-embracing, for it is possible to see almost anything—either made or in the making—from the proverbial needle to the proverbial elephant. But with all the variety of manufactured lines, none is attracting greater attention than that with which the constructional interests are identified. This is particularly noticeable in some of the bulkier products, such as concrete and brick-making machinery, mixers, and other accessories of the builder and contractor. Few of the exhibits dealing with this branch of the nation's industry can be said to be other than worthy of the occasion. In one respect the Exhibition visitor must be catered to, and that is in regard to his taste for "something new." In the exhibits of machinery, in the displays of electric and other fixtures, concrete and brick products, and in the general equipment of the contractor, there is plenty of evidence of something new in design and make; and most of the exhibitors seem to be alive to the opportunity afforded by the Exhibition of appealing to the inquirer's eye as well as to his business instinct by means of first-class photographs illustrating the application and capabilities of various materials.

The number of exhibitors this year is about the same as last. There was the same rush for "space" to the administration offices right up to the very last moment, and in many cases the applications had to be refused. A few old faces are missing, but many new ones are to be seen—this in itself bearing striking witness to the assertion that there is always someone in waiting for opportunity, and that competition and business will not stand still because a few drop out of the race.

We give below brief reports, arranged alphabetically, upon some of the exhibits noticed in the course of our round. If sufficient material is forthcoming we hope to make a supplementary reference to the Exhibition in our next issue, wherein we shall have an opportunity of supplying any shortcomings and publishing supplementary details and reports. Manufacturers are invited to forward brief descriptive paragraphs relating to exhibits of special interest.

Asbestos Manufacturing Company, Limited, Toronto.—This firm's Asbestolate and Linasbestos building board are displayed in a model cottage constructed almost completely of this material. The exhibit also includes the company's asbestos, cement shingles, cement sheathing, etc. It is claimed that the Asbestolate and Linasbestos building board is the only absolutely fireproof cheap building board which can be used as a finished surface, it being composed of asbestos and Portland cement. This company's line of manufacture has been used extensively in the erection of some of Toronto's largest Government buildings.

Bateman-Wilkinson Company, Limited, Toronto.—Among this firm's exhibit of general contractors' equipment are contractors' barrows, wheel scrapers, etc. Contractors' supplies are a specialty of this company, and their exhibit is one of much practical interest.

Batts, Limited, West Toronto.—A well laid out display of veneered and pine doors, staved columns, interior fittings, etc., forms the principal features of this firm's exhibit. The company specialize in interior construction generally, covering newels, balusters, sash and frames, mouldings, "Beaver Brand" flooring, stairs, panelling, etc., and their excellently arranged exhibition displays the best of these lines to good advantage. This company also has a booth outside the Process Building, where a variety of staved columns and other interesting samples of the firm's manufacture is displayed.

Bishopric Wall Board Company, Limited, Ottawa.—Among the various exhibits in the grounds, this company's is an outstanding mark of attraction. A model dwelling illustrates the various uses of the company's lath and stucco boards for both interior and exterior. These wall-boards are claimed to be inflammable and ideal for large and small building purposes. Bishopric sheathing is a special line of this firm's manufacture.

Black Building Supply Company, Limited, Toronto.—In this firm's booth there is an excellent showing of terra-cotta, manufactured by the Northwestern Terra-Cotta Company, Chicago. The exhibits include panels of polychrome and other architectural work. A special feature of this year's exhibit is the display of Knapp Plaster Beads and reinforced Bull-Nose Beads, Sanitary Metal Cove-Bases, and patent scaffolding joints displayed by means of a small model illustrating the method of use. This company specialize in G. & G. telescopic hoists, Covert Improved Fireplace Throats and Dampers, besides various other lines of builders' materials, the chief of which are excellently displayed.

B. O. T. Manufacturing Company, Limited, Toronto.—A variety of complete patented syphon water-closet outfits form this firm's chief exhibits. B. O. T. shippers' desks are another popular line of the company's manufacture, being of the practical and convenient combination type. Their booth contains a well-arranged selection of goods on the above lines.

Brantford Roofing Company, Limited, Brantford, Ont.—This firm are making a feature of their Climax sheeting, insulating paper, and building papers of various kinds, in addition to their roofings. They also have various lines of paint, specializing the "Roof Leak" paint and the Superior roof coating. Asphalt shingles are another of the products of this well-known company.

Buckeye Traction Ditcher Company, Findlay, Ohio.—This is a well-established firm from the States, who have lately set up an agency in Ontario. Their interesting exhibit is attracting much attention. Under demonstration is one of their large open ditchers, used in excavating and sewer work. The company deal largely in traction plows of all kinds. Mr. J. J. Wallace is the sales manager for Ontario and speaks of bright prospects in the province. Some twenty to thirty photos, illustrating the various kinds of machinery in operation, are shown.

Canadian Fairbanks-Morse Company, Limited, Toronto.—A full line of plumbers' equipment, pumping gasoline engines, water systems under demonstration, electric lighting plants, marine engines, etc., are on view at this company's stand in the Exhibition grounds. Mr. G. E. Wheeler is responsible for the arrangement of the various exhibits.

Canadian Independent Telephone Company, Toronto.—In addition to their regular exhibits of wall and desk telephones and telephone equipment, covering both domestic and commercial requirements, this company has on exhibition the Lorimer Presto-Phone System, an automatic telephone, which, as its name implies, is constructed on the "press-the-button" principle. A keyboard consisting of numerals up to 100 is the calling apparatus, by means of which the call is made direct, without any intermediate connection whatever, thus ensuring absolute privacy in conversation as well as quick connection. The system is claimed to be especially suitable for municipal and administration buildings, manufacturing plants, and schools and hospitals.

Cleveland Pneumatic Tool Company, Cleveland, Ohio.—Various samples of this firm's exhibits consist of riveting hammers, Cleveland sand hammers, automatic air-hose couplings and four-piston air drills, of which the company manufacture fifty-eight styles and sizes. One of their prominent features is the Cyclone suction sand blast nozzle for cleaning iron, steel and brass castings, scale from boiler tubes and boilers, etc. "Neverleak" couplings and Cleveland "Veribest" air hose also form part of a highly interesting exhibit.

Consumers' Gas Company, Toronto.—This company have three booths in different parts of the Process Building to accommodate the several branches of their exhibits. A feature of their show this year is the "Modern Safety Gas Iron," which is under demonstration at one of the booths. This iron is made in Toronto, and has the appearance of a thoroughly useful article. The company claim that it does three hours' continuous ironing for one cent's worth of gas. Their booths as a whole cover a well-displayed selection of ornamental lighting fixtures and heating and gas appliances generally, appealing directly to the householder.

John Deere Plow Company of Welland, Limited.—This firm have an exhibition of drag scrapers, contractors' barrows, etc. Dump waggons are another feature of the firm's exhibit, and road plows are also shown to advantage.

Dennis Wire and Iron Works Company, Limited, London, Ont.—An interesting feature of this company's exhibit is their solid steel safe, one-half-inch armored, and constructed to allow of the interior being simply adjusted to meet the exact needs of the user. The drawers and shelves can all be moved and placed in almost any position, allowing of full economy of interior space, the whole forming an absolute fire and burglar-proof compartment. Other examples of this company's unique selection of "Dennisteel" products are exquisite pieces of art-work consisting of two hand-hammered grilles. Mr. MacNeely, who is in charge of the exhibition, informs us that these two exhibits alone are worth as much as $200 each, the design and handiwork being of the most intricate. Other displays comprise bowling club, school, and many other lockers, beautiful samples of cast metal, library stacks with adjustable shelves, steel stools, and other metal utilities of an extensive description, which the firm are constantly manufacturing.

Dominion Belting Company, Limited, Toronto.—This company are exhibiting a special line of their "Maple Leaf" waterproof belting for transmission power. Thresher belts, endless belts and large conveyor belts, belts for elevators, and main drive belts, also form part of this firm's exhibit. Mr. John Scott has charge of the booth.

Dominion Paving & Contracting Company, Limited, Toronto.—This company manufacture a self-impregnating wood preservative, Carbolite Carbolineum, a preparation which can be used to excellent advantage in adding to the tensile strength of all forms of woodwork used in bridges, culverts, docks, scows, sidewalks, floors, block pavements, shingles, telegraph poles, cross-arms, etc. Their chief exhibit is a small house erection illustrating the application of the preservative in various ways. When exposed to the air and sun, the preservative takes the color of a nut brown and the company claim does not require renewing for years. Mr. W. H. Barker has charge of the exhibit.

Dominion Sewer Pipe Company, Swansea, Ont.—Occupy a favorable location at the rear of the Process Building. The feature of this firm's exhibit is their special line of AMCO segment sewer blocks. These vitrified segment blocks are especially adapted for the construction of vitrified sewers ranging from 2½ ft. to 9 ft. in diameter. An example of the work set up forms part of the exhibit. Other displays consist of sewer pipe fittings, chimney tops, field tiles, bricks and paving blocks.

Dunlop Tire and Rubber Goods Company, Toronto.—This company have a booth in the Transportation Building and another in the Process Building, each displaying their attractive line of rubber goods, fire hose, rubber tires, pneumatic and solid tires, rubber mats and matting, etc. The exhibits in both cases are arranged in excellent taste and selection.

Eberhard-Wood Manufacturing Company, Toronto.—This company's exhibit consists of various samples of builders' equipment, comprising iron fire escapes, fences and gates, folding gates, jam guards, and window guards. A special feature is the Athey Cleveland metal weather strip, the method of applying being displayed by means of a model window.

Face Brick Machinery Company, Toronto.—A tastefully laid-out exhibit displays this company's line of face bricks. Various shades of almost every conceivable color are displayed in a neat, artistic manner by means of various models. The brick is made of concrete all the way through, and the color facing is guaranteed not to rub or wear off, it being applied right in the machine. Ten of these bricks are turned out of the machine at one operation. The company is a new venture, and its promotors have every reason to hope for a bright future. For their superintendent, the company have an expert concrete man, Mr. Chas. Day, who has charge of the company's exhibit.

General Machinery Company, Limited, Toronto.—An attractively fitted-up booth displays this company's line of hydro-pneumatic water systems, Lutweiler non-pulsating pumps, etc. A feature of their output is the Skinner system of irrigation, which is specially adaptable for sprinkling purposes in hot-houses, gardens, and all fertilizing grounds.

Goodyear Tire and Rubber Company, Toronto.—A piece of scenery, appealing to the household section and at the same time illustrating the excellent quality of Goodyear rubber hose, is a prominent feature of this firm's exhibition. Two figures are set up on an imaginary lawn, one figure using the Goodyear hose and the other a hose of an inferior make. It is shown how the inferior hose leaks, causing much discomfort to its user, while the Goodyear upholds its reputation and refuses to leak. Other displays consist of belting, fire hose, etc., covering a complete line of the company's excellent rubber goods.

Granite Concrete Block Company, Limited, Toronto.—Showing various examples of their granite-faced blocks, which, they claim, are the last word in the manufacture of cement blocks. The company guarantees that they are waterproof and that they will not graze. The models which the company have set up as part of their exhibit are attractive and interesting.

Gurney Foundry Company, Toronto.—The feature of this company's display is the Gurney-Oxford Round Hot Water Boiler, a complete model of which takes up a prominent position in the centre of the booth. This boiler has been specially adapted for large office buildings, churches, large greenhouses, etc. Well displayed placards set forth the advantages of the boiler, and the exhibit is attracting much notice. Mr. M. R. Griffiths is in charge of the booth.

Jones & Glassco, Montreal.—Exhibiting models of their 60 h.p. and 150 h.p. Renold chain belts. Both line shafts in the Machinery Hall are driven by these belts from an electric motor in the centre of the building—a fact which is featured by an announcement attached to the 150 h.p. belt.

L'air Liquide Society, Toronto.—This firm makes a special feature of demonstrating their oxygen and acetylene welding and cutting methods. Among the exhibits are examples of their high and low pressure acetylene generators, an automatic cutting machine, and samples of cutting and welding tools, etc. An interesting exhibit is a tank, welded and tested by the L'air Liquide process to withstand 1,900 lbs. per square inch, no rivets whatever being used. Mr. L. E. Harp is responsible for the whole arrangement of the booth.

R. A. Lister & Company, Limited, Toronto.—Electric automatic lighting plants form a feature of this company's exhibit. It is claimed that the plant forms a most economical medium for house and ground lighting. Other exhibits are gasoline engines, cream separators, and various forms of contractors' power machinery, generating and battery sets, etc.

Massey-Harris Company, Limited, Toronto.—Various lines of their gasoline engines are the principal exhibits at this company's booth. Other features are the Massey-Harris grinders, which are under demonstration. A new model is on exhibition, this having been designed of a size to accommodate a larger output than the previous grinders which this firm have put on the market.

Geo. B. Meadows, Toronto, Iron, Wire and Brass Works, Limited.—An attractive and well-fitted booth in the Industrial Building shows this company's line of metal goods. Samples of wire belt guards, cast metal work, bank tellers' cages, steel gymnasium, moth-proof and various other types of lockers, and metal domestic appliances form features of the exhibit. In one corner of the booth is a sample of spiral staircase in which the firm is specializing. The frontage of the booth forms, in itself, an excellent display of the firm's metal work.

Metal Shingle and Siding Company, Preston.—Are making a special feature of their Preston Universal Garages, models of which are on exhibition. These garages are built at the Preston factory and are sent out in sections all ready to set up. There are no complicated parts to put together, and the whole forms an excellent and handsome portable garage.

Milton Pressed Brick Company, Limited, Toronto and Milton, Ont.—In the Government Building, this company have an interesting exhibition of their various lines of brick manufacture, combining an extensive number of designs. Milton Pressed Brick was used in the construction of MacDonald Colleges at St. Annes and at Guelph, also the Normal School, London, and the Drill Hall, Toronto, as well as various other public buildings. The Milton brick is made of iron shale, which, it is claimed, is a hard heat-resisting substance giving the brick smoothness of texture. The exhibit is set up in excellent taste.

James Morrison Brass Manufacturing Company, Limited, Toronto.—The Stack Distant Control System of hot water heating, for domestic use, forms an interesting part of the company's exhibition this year, the apparatus being connected up for demonstration, and making an interesting display. This firm's exhibit occupies a prominent place, and takes up a large amount of floor space, all of which is used to the best advantage in the display of their numerous lines of engineers' equipment, locomotive injectors, J.M.T. reducing valves, steam whistles, steam, ammonia, water, air, compound and vacuum gauges, steam gauge testers, etc. All this company's goods have been approved by the Board of Inspectors for the Provinces of Ontario, Saskatchewan, Alberta and British Columbia. The booth, which is in charge of Messrs. Bretton and Dobbin, is strikingly attractive, it being well illuminated with handsome electric fixtures, which are also a part of this firm's line of manufacture.

McFarlane Ladder Works, Toronto.—This company are making a feature of their special extension ladders for builders and contractors, one large model of which is attracting much attention. The extensions are easily adjustable and are excellent in their economy of space. The ladders are durable and are made for interior and exterior work. Painters' trestles, swing stages, and pulley extension ladders, are all part of this firm's line of manufacture. It is claimed that one set of the McFarlane extension trestles will take the place of four ordinary trestles. The company's extension planks can be adjusted to fit different sized rooms and will always lie even on trestles. They are also handy for carrying up stairways, one of their great features being portability.

Page Wire Fence Company, Limited, Walkerville, Ont.—Concrete wire reinforcement—for concrete road pavement, bridges, and building floors—is a specialty of this company's output. The firm are the originators of Page wire reinforcement in flat sheets, and various examples of their work are displayed in the grounds of the Exhibition.

William Peace Company, Limited, Hamilton.—With the use of model windows, this company are making a good display of their Peace patent improved metal weather strips for windows and doors. The metal is claimed by the company to be dust and wind-proof, and is made in zinc, brass, bronze and copper. Mason's patent non-slipping stair treads are another feature of the Peace Company's exhibit.

Pease Foundry Company, Toronto.—Featuring all sizes of "Economy" heaters and furnaces. In the centre of their booth is exhibited a completely connected cellar hot air furnace with pipes leading up to an imaginary cellar ceiling, the whole forming an attractive model and appealing directly to the building contractor. Other examples of this company's lines are exhibited, consisting mainly of "Pease" smokeless down draft boilers, upright section steam and water boilers, tank heaters, steam and water radiators, and combination heaters, steam heaters, ventilators and registers especially suitable for burning coal or wood.

Pedlar People, Limited, Toronto.—An extensive display of steel corrugated work, shingle and roofing metal, piping, culverts, etc., comprises the principal features of this company's exhibit. A specialty of the Pedlar People's output is the "Toncan" metal—an anti-corrosive and heavily galvanized product, various samples of which were displayed. Two model garages illustrate the adaptability of this company's products.

J. A. Pringle, Toronto.—An excellent exhibition of leaded art window glass, specializing the "Easyset" system of glass setting for shop fronts, ets., and displaying a well-chosen variety of samples of art glass. This firm specialize in metal store-front construction, an illustration of which is to be seen in the shape of a model miniature store-front erected at the rear of the booth.

Ramsay & Son Company, Montreal.—A tastefully laid-out booth exhibiting superior lines of paints. Five or six compartments at the rear of the booth are used to demonstrate the color effects attainable with this company's line of tints, comprising mahogany furniture stain, Dulton white, white enamel, light oak, and other artistic shades. Ramsay's paints are used extensively for both interior and exterior work, and form an excellent decorative medium and finish for both.

James Robertson Company, Limited, Toronto.—Plumbing and lavatory equipment are displayed by this firm to excellent advantage in their large booth in the Industrial Building. An outstanding feature is the display of lead piping, made at the company's own lead mine, and varying from ⅛ in. to one foot in width. A piece of the original ore is also exhibited. Other exhibits are the Robertson-Riley faucets, and cone return valves, Peerless boilers, etc. The booth is in charge of Mr. A. L. Phipps.

Standard Ideal Company, Limited, Port Hope, Ont.—Displaying an excellent selection of their chief lines in "Twentieth Century" bathroom and lavatory equipment. The exhibits consist of almost every kind of porcelain enamelled bath, kitchen and laundry equipment, sinks, bowels, receptors, showers, etc. This company's booth occupies a prominent space in the Process Building.

Standard Sanitary Manufacturing Company, Limited, of Canada.—This company's exhibit consists of an elaborate display of porcelain enamel sanitary goods, drinking fountains, bath tubs, shower, foot and sitz baths, wash basins, kitchen sinks, etc. An interesting feature takes the form of two bathrooms, with tiled walls and floors, completely equipped with attractive samples of the firm's products in the lines above mentioned. This excellently equipped booth is in charge of the company's representative, Mr. E. H. Archer.

Steel & Radiation, Limited, Toronto.—Royal steam boilers, the King hot water radiator, tank heaters and laundry heaters, are the chief exhibits to be found at this firm's booth. Messrs. J. H. Wilson and T. W. Rogers are in charge.

Triplex Weather Strip Company, Toronto.—Three model windows and a door are being used to exhibit this company's special line of Triplex "all-weather" strips. These strips, it is claimed, will last a lifetime, and are an absolute protection against draughts and cold winter storms, keeping the interior free from dust and germ-laden air.

J. J. Turner & Company, Peterborough.—One of the first exhibits to attract the eye on entering the Exhibition is the J. J. Turner & Company's stand near the entrance. This company have an output of almost every kind of canvas goods, contractors' tents, etc. They also supply complete equipment for contractors' camps, such as cots, blankets, etc. Mr. Reginald Turner, who is in charge of the exhibit, informed us that the company have lately been working twenty-four hours a day on a large war order for the Russian Government.

Waldon Company, Limited, Toronto.—Exhibiting their line of Spencer self-feeding boilers, heaters, etc. A Spencer heater, a duplicate of one now installed in the Hydro Administration Building, on University Avenue, Toronto, is an interesting feature. This heater will shortly be placed in the same building as the other one, and it is expected that the two will form a most satisfactory heating equipment. Mr. R. S. Robinson has charge of the exhibit. This company are also specializing in pressed iron radiators and Kriebel vapor systems.

Wettlaufer Brothers, Toronto.—An excellent display of concrete mixers, of the stationary and tilting drum, hand and power-driven type. Cement blocks and cement tile machines are also prominent exhibits. A feature of the company's manufacture is a patent bag-holder especially designed for holding open bags used in concrete mixing and stone crushing. The Wettlaufer stone crusher is another important exhibit, and gasoline motors are also shown.

Personal Mention

IN this column it is proposed to publish a series of sketches of men formerly identified with the Canadian constructional interests but now serving with the Colours. Such a series cannot fail to be of considerable appeal, and we shall be glad if our readers will co-operate with us by submitting photographs of their friends and the required details, making a particular point of telling exactly what their connection was with the engineering or contracting field, and stating in what capacity and with what unit they are now serving. The object of our first sketch is

Lieut.-Col. Hendrie, Vice-President Hamilton Bridge Works Company.

Lieut.-Col. William Hendrie,

best known to our readers and to us as Vice-President of The Hamilton Bridge Works Company, Limited. A native of Hamilton, Col. Hendrie was educated at Upper Canada College, and identified himself with constructional operations at an early age. He became a Captain in the 48th Highlanders on the organization of that regiment in 1891, and passed through the successive stages to the post of Commanding Officer, which he occupied from 1911 to 1913. He volunteered for active service on the outbreak of the war, and joined his old regiment, the 48th Highlanders, as Junior Major. He accompanied his regiment to Valcartier, and soon afterwards was placed in charge of the Canadian Remount Department. In the fall of 1914 he proceeded to England, where he is still engaged in the work of this department.

Mr. Joseph Daw, a well-known St. Catharines architect, has received a commission in the Royal Engineers, and has left for Ottawa. He has already seen active service as Sergeant-Major with the Royal Engineers during the South African Campaign.

After an illness of over a year's duration, Mr. L. G. Ecrement, Secretary-Treasurer of the City of Maisonneuve, P. Q., died on August 29, aged fifty years. He was connected with the municipality for twenty-six years, and had much to do with the progress of the city.

Mr. George T. Holloway, the eminent metallurgist, of London, England, who has been appointed Chairman of the new Ontario Nickel Commission, has arrived in Canada. It is stated that the commissioners will lose no time in entering upon their investigation of the nickel resources of Ontario, the possibilities of refining the ore, and so on. Before coming to Canada Mr. Holloway gathered much useful information dealing largely with the extent of the nickel market and its possibilities of development after the war.

Mr. J. G. Rumney, General Manager of the Detroit Steel Products Company, has left Detroit for an extended business trip throughout the western territory. He will visit some of the principal cities in which the company is represented and will endeavour to obtain first-hand information relative to conditions affecting the building trade in those territories. Whilst construction reports show that building has not been normal this year throughout the country generally, the steel sash business has shown an increase. Each month has shown a substantial increase over the corresponding month of 1914, and the business secured during the first half-year was greater than for any other first six months in the history of the Detroit Steel Products Company. Before returning to Detroit in the latter part of September, Mr. Rumney will spend some time at Glacier National Park, in Montana, and at Vancouver.

Progress on Elevator Work at Vancouver

According to a Vancouver despatch, work is now well under way on the erection of the grain elevator which is to be built on the Government dock property on Burrard Inlet. The site for the plant has been excavated, and concrete is being poured on the footings for the lower piers of the main buildings. The sea wall, 800 feet long and 300 feet wide, has been completed, with the exception of a small section which is being used to drain the water from the covered-in area, and five dredges are dumping material into the portion to be reclaimed. The dirt is scattered by hydraulic jets. More than 200,000 cubic yards of material have been placed on the tract, this amount being approximately half the quantity required to complete the fill. It is estimated that the dock will be finished—so far as the general construction goes—by the middle of October or early in November.

A force of nearly two hundred men are engaged on construction work at the elevator site. The main buildings and bins will be of reinforced concrete construction. The plant will have a capacity of one and a quarter million bushels. Galleries extending the entire length of the wharf will be built along either side, as part of the elevator system. The location for the tracks leading to the plant has been partly filled in.

The Barnett-McQueen Company, of Fort William, has the elevator contract. Mr. W. Bryden is the superintendent and Mr. E. D. Mayor the consulting engineer.

The International Petroleum Company are stated to have purchased a site at Church and Court Streets, Toronto, for the erection of a large office building, operations upon which will be commenced shortly. The site is 70 ft. x 130 ft. in dimensions.

Mainly Constructional

East and West From Coast to Coast

The foundations are in for a school and residence to be erected at Lachine, Que., at a cost of $150,000. The plans were prepared by Messrs. Viau & Venne.

Burnall, Limited, Toronto, Ontario, is the name of a new firm organized with a capital of $200,000 for the manufacture and installation of lighting and heating plants.

At Ottawa, a good-sized contract has been let to the Ottawa Construction Company. The work is for asphalt and sandstone block paving on Preston Street, and the estimated cost is $120,000.

The city of Lachine have accepted the tender of the Atlas Construction Company, Montreal, for an incinerator destroying twenty tons every twenty-four hours. The incinerator will be of the Decarie type.

Interior work is in progress on the Orphanage which is being erected on Decary Boulevard at a cost of $175,000. The architect is Mr. A. Piche, and the general contractors are The Deakin Construction Company.

The General Supply Company of Canada, Limited, Ottawa, Ont., have opened an office at 408 McGill Building, Montreal, in charge of Mr. G. W. Robb. They handle railway supplies, concrete machinery, pumps, etc.

The Truro Steel Company, Limited, lately organized with a capital of $200,000, has purchased the plant and property of the Truro Engineering Works, Limited, at Truro, N. S., and will engage in the manufacture of shells.

The Quebec Paving Construction Company have been awarded the contract for the Quebec City portion of a new boulevard which is being erected by the City of Quebec and the Provincial Government. The job is worth $105,000.

A Calgary despatch is authority for the statement that the Canadian Western Foundry and Supply Company, with plants in Alberta cities, have received an order for $6,000,000 in shells and that it is possible that an additional plant may be erected.

The first sod has been turned by the municipality of South Vancouver on the work of making connections with the trunk sewers laid by the Vancouver and District Joint Sewerage and Drainage Board. The undertaking will cost the municipality more than $300,000.

For the fiscal year 1914-15 the expenditure of the Quebec Government on roads was $341,226, in addition to which $5,713,082 was expended under the Good Roads Act 1912. On the other side of the account $81,473 interest was received from municipalities under the same act.

Good progress has been made on the erection of the First Church of Christ Scientist on River Street, Winnipeg, and the exterior work is nearing completion. The architects for this building are Messrs. Jordan & Over, and the general contractors the Fort Garry Construction Company.

The official programme of the Pan-American Congress which is being held under the joint auspices of the American Road Builders' Association and the American Highway Association at Oakland, Cal., September 13th to 17th, contains many features of interest. There will be papers and discussions by leading highway engineers and road builders from all parts of the United States and Canada. It is of interest to note that one of the presiding officers is Mr. W. A. McLean, Chief Engineer of the Ontario Highway Commission, and a former President of the American Road Builders' Association.

E. T. Ramsay, Limited, is the name of a new firm with head office at St. Lambert, Que., and a capital of $50,000, incorporated to manufacture and deal in building materials and contractors' supplies. The incorporators include E. T. Ramsay, of Westmount, Que., and H. S. Thompson, of St. Lambert.

A despatch from Ottawa states that a favorable report on the oil shales of New Brunswick has been received from Dr. Clapp, the U. S. expert, who states that he found the prospects for petroleum in this province very promising. The shale belt is chiefly in Albert County, about forty miles from St. John.

Russell Fireproofing, Limited, has been incorporated with a capital of $250,000, to manufacture and deal in fireproofing and clay and shale products generally. The directors include Andrew Walker, H. Kenney, J. A. Cochrane, and R. M. Warner, all of Russell, where the head office of the company is to be situated.

The Port Moody (B. C.) Council are negotiating with a steel works for the establishment of a plant there. An expert report is to be submitted, after which it is proposed to submit a by-law guaranteeing the company's bonds for $100,000. The company, which is known as the Port Moody Steel Works, has secured a site of one hundred acres.

Tenders are now being received by the architect, Mr. J. C. Storey (Northern Bank Building, Seattle), for the greater part of the work and equipment required in the construction of an oil plant at Burnaby, B. C., the cost of which is estimated at $110,000. Operations are to commence at an early date. The owners are the Shell Oil Company, of Vancouver.

At Winnipeg, work is reported in progress on the office building which is being erected on Main Street by F. W. Scott according to plans prepared by Messrs. Pratt & Ross. The general contractors are Messrs. Hazelton & Walin. The building is to be six storeys high, of reinforced concrete, terra-cotta and hollow tile construction, and is estimated to cost $120,000.

A Toronto contractor last week omitted an item of $700 from his contract for heating and ventilating the addition to the Manning Avenue School. The contract was accepted, but the mistake was discovered later, when the contractor asked permission to withdraw from the work. It is understood that the request will be granted, but it will mean the sacrifice of a deposit of $139.

The contract for a new picture theatre, on Park and Laurier Avenues, Montreal, has been let to Nicholson Constructions, Limited, Montreal. The building is from plans drawn by Mr. D. J. Crighton, Montreal; it will be on a site 60 x 105 ft., and will be 60 feet high. The exterior is to be of cream glazed terra-cotta, while the general construction will be of steel, fireproof hollow tile, and reinforced concrete.

The formal opening of Toronto's new Technical School, erected at a cost of two million dollars, took place on Tuesday, August 31st. The ceremony was performed by Sir John Hendrie, Lieutenant-Governor of Ontario, in the company of many distinguished guests, including Archbishop McNeil, the Bishop of Toronto, the Hon. G. Howard Ferguson, Sir Edmund Walker, and many others prominent in the business and social life of the city.

The Dominion Bridge Company is reported to be maintaining a steady output of 2,000 shrapnel and 1,500 high explosive shells daily, and it is reported that this output will soon be increased over fifty per cent. The Montreal Ammunition Company is making six thousand finished cartridge cases a day at the Lachine plant of the Dominion Bridge Company, and is rapidly installing equipment for the manufacture of large calibre shells for which it has received contracts.

The Hudson Bay Company's new block at Victoria, illustrated in our last issue, has been completed with the exception of the interior finishing. The contractors, the B. C. Construction Company, Limited, commenced operations early last year, and the work has proceeded in spite of the financial disturbance brought about by the war. The new block is in terra-cotta, conforming with the design of the company's new building in Vancouver, which will be occupied this fall.

Some thirty employees of the Don Valley Brick Works, Toronto, have responded to the Empire's call for overseas service. The names are: Messrs. Bert. Mattieson, William Galloway, Harry Burgess, Thomas Lillie, Fred Clark, William Fletcher, William Wheeler, James Dowse, Thomas Hallam, John MacDonald, Richard Gregory, E. Gregory, Harry Shoemaker, James Stapley, Harry Seale, William Templeman, T. Swan, William Harris, John Harris, John Beverley, H. Grant, Samuel Johnston, William Luxton, Bert. Crook, Matthew Fleming, Sr., Matthew Fleming, Jr., Fred. Fletcher, and Bert. Whitehead.

At St. John, N. B., the Town Planning Commission has taken the second step in its forward movement by submitting for public inspection the plan of the area over which it will have jurisdiction. This area includes a strip of territory three to five miles from the centre of the city, extending from Courtenay Bay to the Kennebecasis River, and across the River St. John, taking in all the South Bay district and running down to the Bay of Fundy coast at Manawagonish Bay. If this plan meets with public approval the next step will be to lay out roads and parks, and provide for future residential and industrial development within the area.

The newly organized Institute of Paving Brick Manufacturers is holding a convention at Alton, Ill., on September 22nd. This place has been selected on account of the opportunity it affords to visit the plant of the Alton Brick Company. It has become the rule of the Institute to combine the inspection of plants with theoretical study, and the investigations at Alton will follow upon those pursued at the plant of the Bessemer Limestone Company in Youngstown and at the Metropolitan Paving Brick Company's plant at Canton, Ohio. A cordial invitation is extended to every paving manufacturer to attend the Alton meeting. Full particulars may be obtained of Mr. Robert Keplinger, care of the Metropolitan Brick Company, Canton, Ohio.

The concrete and stone work on the University residence at Saskatoon has been completed by the contractors, Messrs. Richardson Builders, Limited (Winnipeg and Saskatoon), who are proceeding to cover in the building and install a temporary heating system so that the concrete may be protected during the winter months. The building has a number of special features. It is a storey higher than any of the other University buildings. The basement is of solid concrete, providing plenty of space for storage room, gymnasium, and swimming pool. The outside of the building is finished in cut Bedford stone, conforming with the other buildings, and is ornamented with castellated cornices, gables and towers. At the present time the work is rather more than two-thirds completed. A large number of men are emploped by the contractors. The masons on the stone work receive $7 a day.

In an address delivered recently at St. John, N. B., Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation, said that the enterprising New Brunswick city had taken the lead in town planning, and that it would probably be the first city to adopt a town planning scheme. Speaking of the plan now under consideration, Mr. Adams said that he believed that the preliminary stage would be covered in a few weeks, but that the working out of the details would defer the consummation two years, perhaps. In the course of his address Mr. Adams stated that he had been asked why town planning should be urged during the war. He regarded the present as the best time for prosecuting schemes which promoted public health and brought about better housing conditions. In England two hundred cities had started to adopt town planning schemes, and half of these now had the authority to go ahead with them. So far no Canadian city had a definite project.

Town Planning Recommendations for Port Credit

The Port Credit (Ont.) Board of Trade met last week to consider a suggestive report submitted by Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation, Ottawa. This is the first report issued by the Department to any municipality in Ontario. After commenting upon the peculiar advantages for industrial or residential development enjoyed by Port Credit, Mr. Adams suggested that the following matters be given immediate attention:

(1) width and character of construction of the proposed Toronto to Hamilton Highway intersecting district; (2) alignment of highway with special regard to its effect on the harbor; (3) size of the harbor needed, and plan of development to be agreed with the Government; (4) provision of good hotel facilities to meet needs created by new highway and improved amenities of district; (5) preservation of good open spaces on lake front, and adjoining railway to give good appearanie to town and attract visitors. Protection of river banks; (6) improvement of railway station and surroundings and consideration of position of railway crossings; (7) creation of larger municipal area by taking in partially developed land outside the present boundaries of the town; (8) selection of sites for public buildings, etc.; (9) delimitation of special areas for factories, etc.; (10) consideration of police regarding width of streets and character of construction, so that short residential streets may be at the minimum cost, and adequate provision be made for main highways; (11) consideration of lines of main highways, so as to enable sufficient width to be secured before development takes place or at least to enable good set-backs to be obtained in respect of buildings erected on frontage of such highways.

The Osgood Company, of Marion, Ohio, manufacturers of steam shovels, dipper dredges, etc., have sent us a copy of a picture folder (No. 12) which illustrates in a number of excellent half-tone views the application and operation of this firm's well-known equipment. One of the views shows the Osgood "18" excavating a sewer trench 15 feet deep. Here the shovel is fitted with a power device to facilitate the ready change of the angle of the boom to suit digging conditions. Another view shows an Osgood dredge digging 30 feet deep—an operation which enables the sand and gravel plant to carry out its work with the greatest efficiency.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Cap Sante, Que.
Tenders on the construction of a macadam road will be received until September 6th by the Municipal Secretary, J. A. Frenette. Plans and specifications with the Secretary.

Cleveland Township, Que.
The Municipal Council have passed a by-law providing for the macadamizing of a portion of the Valley Road, about 8,000 feet in length. Mayor, J. Smith, Richmond.

East Whitby Township, Ont.
The Township Council are considering a $15,000 debenture issue to cover the cost of repairs to highways, recently damaged by storm. Reeve, James McKenzie, Whitby.

Edmonton, Alta.
Work by day labor has been started on the construction of sewage disposal works, estimated to cost $30,000. Engineer, A. J. Latornell. Concrete construction.

Ingersoll, Ont.
The Town Council are considering the laying of a vitrified brick pavement on Charles Street. Clerk, W. R. Smith.

The Town Council are considering the extension of the brick pavement now being laid on Thames Street a further three block north. Clerk, W. R. Smith.

Markham, Ont.
A by-law providing for extensions to the waterworks system at an approximate cost of $20,000, will be submitted to the ratepayers on October 2nd. Work will include new mains, tank and collecting basin with a capacity of 60,000 gallons. Consulting Engineer, E. A. James, 57 Adelaide Street E., Toronto.

North Bay, Ont.
The Town Council will receive tenders until September 9th for the supply of 1,330 lineal feet of concrete pipe, diameter 30 inches. Plans and specifications at office of the Engineer, H. J. McAuslan.

Ojibway, Ont.
The Town Council are considering the installation of a tile drainage system at an early date. Clerk, J. Moynahan, 21 Parent Avenue, Windsor.

Prescott, Ont.
The laying of asphalt paving on King Street is contemplated by the Town Council. Clerk, George Rook. Approximate cost, $35,000.

Preston, Ont.
Plans are being prepared for a sanitary sewer to be laid on a portion of King Street. Town Clerk, H. C. Edgar.

Work is in progress on the construction of sewers on a number of streets. Material all purchased. Approximate cost, $8,195. Engineer, C. S. McKenzie.

Simcoe, Ont.
A concrete pavement is being laid on Colborne Street by day labor under supervision of the Engineer, W. G. Marston.

South Norwich Township, Ont.
The Township Clerk, Alexander McFarlane, Otterville, will receive tenders until September 13th for the construction of the Banslaugh Creek Drain. Engineer, F. J. Ure, Woodstock.

St. Catharines, Ont.
The City Council are considering the enlargement of the outlet of the trunk line sewer at Carlton Street. Engineer, W. P. Near.

St. John, N.B.
The retaining wall on Moore Street will be built by day labor.

St. Marys, Ont.
The construction of a watermain on James Street is contemplated by the Town Council. Clerk, F. M. Clark.

St. Romuald, Ont.
The Municipal Council are considering the purchase of two electric pumps, ten hydrants and 1,000 feet of standard fire hose. Secretary, J. T. Lemieux.

Toronto, Ont.
Tenders will be received until September 7th by the Board of Control for asphalt, asphaltic concrete, bitulithic and brick block paving and concrete sidewalks and curbings on a number of streets. Plans and specilcations at office of the Works Department, City Hall.

West Kildonan Township, Man.
The Township Council contemplate the construction of plank sidewalks on a number of streets. Secretary, W. Ballard, West Kildonan.

Woodstock, Ont.
Tenders on laying a concrete pavement will be received until September 4th by the City Clerk, John Morrison. Plans and specilcations at office of Engineer F. J. Ure.

CONTRACTS AWARDED

Burlington, Ont.
The Town Council have let the contract for the construction of a collecting gallery at the pump house to G. E. Moogk, Main Street, Weston.

Hamilton, Ont.
The contract for the erection of a store and pump house at the Beach Pumping Station has been let by the City Council to John Poag & Son, Westinghouse Avenue.

Hull, Que.
The contract for the supply of 6-inch, 8-inch, 10-inch and 12-inch cast iron pipe has been let by the City Council to the Canada Iron Corporation, 88 Victoria Square, Montreal.

Maillardville, B.C.
The contract for the supply of material for waterworks construction has been let to Widdess, McDonald & Company, 525 Seymour Street, Vancouver, at $3,250.

New Toronto, Ont.
The contract for extension of the intake pipe into the Lake has been let by the Town Council to the Dominion Construction Company, 10 Wellington Street E., Toronto. Approximate cost, $5,000.

Quebec, Que.
The general contract for boulevard construction on St. Louis Road has been let to the Quebec Paving Construction Company, 70 Tenth Avenue, Limoilou. This contract is for the Quebec City portion only. The remaining part is to be done for the Provincial Government. Approximate cost of work, $105,000.

Sombra Township, Ont.
Work is about to start on the construction of a drainage system, estimated to cost $42,882. A contract for dredging and about six miles of team work has been let by the Township Council to the Lakeside Dredging Company, Windsor, Ont., at $18,299. Contracts for bridges will be let later.

Upper Melbourne, Que.
The contract for macadamizing the River Road has been awarded to O'Connor Bros., Huntingdon, Que., at $5,830.

West Lorne, Ont.
The Village Council have let the contract for the construction of a drainage system to G. H. Conibear, St. Clair St., Chatham, at $4,500.

Railroads, Bridges and Wharves

East Whitby Township, Ont.
Tenders on the construction of nine small reinforced concrete and steel bridges will be received until September 13th by the Township Clerk, W. Purvis, Columbus, Ont. Engineers, Bowman & Connor, 31 Queen Street W., Toronto.

Magog, Que.
Work is about to start by day labor on the construction of a crib work dam. The city of Sherbrooke, the Brompton Pulp and Paper Company, the Paton Manufacturing Company, Sherbrooke, and the Sherbrooke Street Railway Company are interested in the project.

Peterborough, Ont.
The City Council are considering plans for a reinforced concrete bridge to be built on Bonacord Street, at an approximate cost of $2,915. Engineer, R. H. Parsons.

CONTRACTS AWARDED

Kincardine Township, Ont.
The Township Council have let the general contract for the construction of

two bridges to David Keyes, Kincardine, at $7,650.

Ottawa, Ont.
The contract for the substructure of the Pretoria Avenue Bridge has been awarded by the City Council to Roderick Brewder, 317 Lyon Street. Approximate cost of bridge, $31,000.

Perth and Wellington Counties, Ont.
A contract for the erection of a concrete bridge for the County Councils has been let to John Tilker, Harriston, Ont.

Public Buildings, Churches and Schools

Beamsville, Ont.
A by-law to provide $20,000 for the erection of a High School has been defeated.

Bothwell, Ont.
The Town Council will be in the market shortly for seating for the Town Hall now in course of erection. Clerk,

W. H. Bradley.

Stratford, Ont.
Plans are being prepared for alterations and additions to the Central Methodist Church. Work will consist of a new front entrance, two towers and a six-roomed addition to the Sunday School. Pastor, Rev. Dr. Manning.

Tara, Ont.
The Town Council contemplate the purchase of a number of school desks. Clerk, W. J. Taylor.

Toronto, Ont.
Tenders on the erection of an eight-roomed school on Gledhill Avenue will be received until September 10th by the Board of Education. Plans at office of the Building Superintendent, City Hall.

CONTRACTS AWARDED

Halbrite, Sask.
The School Board have let the general contract for the construction of a school to H. E. McKenzie, Fourth St., Estevan. Estimated cost, $6,000.

Hamilton, Ont.
The contract for painting in connection with the addition now being erected at the Hospital on Barton Street E. has been let by the Hospital Board to E. F. Tallman, 189 East Avenue West.

London, Ont.
The contract for installing electric wiring and fittings at the Customs House and Post Office has been awarded by the Department of Public Works, Ottawa, to the Benson-Wilcox Electric Company, 264 Dundas Street, London.

Lyall, Man.
The contract for the erection of a school for the Trustees of the Prosperity School District has been let to Fraser & McDonald, 512 Gertrude Avenue, Winnipeg. Estimated cost, $12,000.

Middlechurch, Man.
In connection with the addition of the Old Folks Home, the roofing contract has been let to G. Goodman, Toronto and Notre Dame Streets, Winnipeg, and the electrical contract to the Marriott Denbigh Electric Company, 490 Main Street, Winnipeg.

In connection with the addition to the Old Folks Home, the sub-contracts for masonry, carpentry, painting and interior fittings have been let to the general contractors, S. Brynjolfsson & Company, 606 Builders' Exchange, Winnipeg, and for heating and plumbing to Pattenden & Fraser, 66 Noble Avenue, Elmwood.

Milton, Ont.
The contract for roofing at the Registry Office now in course of erection has been let to Turnbull & Cutliffe, Brantford.

Moncton, N.B.
The contract for ventilating, plumbing and heating at the Aberdeen School, now in course of erection, has been let to Hagen & Company, Church Street, Amherst, and for terra cotta work to J. C. Berrie, 48 Princess Street, St. John.

Montreal, Que.
The general contract for the erection of a Presbytery in Ahuntsic Ward has been let to Lemieux & Blais, St. Clair Street, Ahuntsic Ward. Architects, Gauthier & Daoust, 180 St. James Street.

The Deakin Construction Company, 41 Mayor Street, have been awarded the contract for painting at the Orphanage being built by them on Decary Blvd.

Newcastle, N.B.
The following contracts for work at the Miramichi Hospital have been let by the Hospital Board:—heating and plumbing, F. W. Summer & Company, Wesley Street, Moncton; electrical work, Canadian Gear Works, Newcastle; galvanized iron work, J. E. Wilson, Ltd., 17 Sydney Street, St. John.

Ottawa, Ont.
The Carlton Construction Company, Union Bank Building, Ottawa, have been awarded the contract for the partial removal of a tower at the Victoria Museum. Contract price, $13,990.

St. Eustache, Que.
The general contract for the erection of an addition to the College has been let by the School Commissioners to Douquette & Frere, St. Eustache. Approximate cost, $10,000.

St. Ulric, Que.
The contract for the installation of a heating system at the Parish Church has been let to Wilfred Berube, Fraserville.

Wallaceburg, Ont.
The following contracts have been let in connection with the school now in course of erection:—masonry, F. McGregor, William Street; carpentry, W. D. Shaw, 139 William Street, Sarnia; heating and plumbing, Alexander Joss, 203 Front Street.

Waterford, N.S.
Work has been started on the erection of a church for the congregation of St. Agnes Parish by D. J. McIsaac, Victoria Street, Glace Bay. Approximate cost, $16,000.

Windsor, Ont.
The contract for the supply and installation of seating at the church which has been erected for the Colored Baptist Congregation has been let to the Globe Furniture Company, Shantz Avenue, Waterloo.

Winnipeg, Man.
The following contracts have been let in connection with the church in course of erection at River Heights for St. Andrew's Presbyterian Congregation:—masonry, carpentry, steelwork, roofing, plastering and painting, Grey & Davidson Company, Limited, 621 Wall Street; elecerical work, McDonald & Willson Lighting Company, 309 Fort St. Heating and plumbing not let.

The contract for roofing, galvanized iron work, metal ceilings, copper doors and steel sash at the school being built on Polson Avenue has been let to J. A. Glasgow, 532 Agnes Street. The steel sash and copper doors are being made by A. B. Ormsby Company, King Street West, Toronto.

Yarmouth Township, Ont.
The following contracts for the erection of a school have been let by the Trustees of School Section No. 18:—masonry, Horton Bros., 5 Hughes St.; carpentry, Alfred Morris, 68 Elysian St.; roofing, C. Riddle, 58 Railway Street; plastering, Harry Rival; painting, E. Dallyn, St. George Street; tinsmithing, Ingraham & Davey, 468 Talbot Street. Heating not let.

Business Buildings and Industrial Plants

Dutton, Ont.
A. D. Urlin, Queens Hotel, is about to remodel his premises at an approximate cost of $3,000. Interior fittings and equipment will be required.

Glen Rae, Ont.
Hugh Johnston contemplates the erection of farm buildings estimated to cost $3,500. Cement and stone construction.

Orillia, Ont.
Walker Bros., West Street, have commenced the erection of a garage by day labor. Concrete construction, fireproof windows.

Ottawa, Ont.
Work has been started on the erection of an addition to a warehouse for the Bate Realty Company, Slater Street. Contracts for heating, plumbing and electrical work will probably be let later.

Portage la Prairie, Man.
The erection of a distributing station is contemplated by the Canadian Oil Company, Limited, 2 Strachan Avenue, Toronto. Work will include four large storage tanks.

Ruthven, Ont.
Gueranzey Bruner contemplates the erection of fireproof farm buildings, estimated to cost $6,000.

Scotland, Ont.
Work has been commenced by J. Potts on the erection of a store and residence, estimated to cost $3,500. Frame and white brick construction, shingle roofing.

St. Marys, Ont.
Weir & Weir, Church Street, are about to remodel premises for knitting factory.

St. John, N.B.
Tenders on remodelling a building on Charlotte Street for La Provincial Bank will be received until September 10th by the Architect, H. H. Mott, 13 Germain Street. Estimated cost, $12,000.

Tara, Ont.
Work is about start on the erection of

an addition to the premises of F. T. Hill & Company. White brick construction, felt and gravel roofing. Estimated cost, $3,500.

Toronto, Ont.
The Board of Control will receive bulk tenders until September 14th for the construction of a barn at the Jail Farm, Yonge Street. Plans and specifications at office of the City Architect, City Hall. Reinforced concrete and hollow tile construction, concrete foundation and floors. Approximate cost, $25,000.

The International Petroleum Company, Dominion Bank Building, are about to erect a large office building at Church and Court Streets. Secretary, H. F. Miller.

In connection with the factory in course of erection on Dundas Street for LePage Individual Communion Cup Company, 102 Tyndall Avenue, the tenders for plumbing, heating, electric wiring, etc., will remain open until September 15th.

West Nissouri, Ont.
John Pardy, Concession 4, West Nissouri, Thorndale, proposes to erect fireproof farm buildings at a cost of $3,200. Concrete and stone construction.

CONTRACTS AWARDED

Assiniboia, Man.
The general, masonry, carpentry, roofing, plastering and painting contracts for the erection of a telephone exchange on Ness Avenue have been let by the Department of Public Works, Winnipeg, to Grey & Davidson, Limited, 621 Wall Street, Winnipeg, the contract for heating and plumbing to Bearisto Plumbing Company, Limited, 286 Fort Street, and for electrical work to McDonald & Willson Lighting Company, 309 Fort Street. Work is in progress.

Comber, Ont.
The contract for painting in connection with the garage now in course of erection for W. Keith, Comber, has been awarded to W. H. Palmer, 83 Adelaide Street S., Chatham.

Durham, Ont.
Work has been started by F. Luney, Elmwood, on the erection of a hydro electric sub-station for the Village Council. Red pressed brick construction, concrete floors and ceiling.

Kingston, Ont.
Work is progressing on the erection of a factory at Rideau and Cataraqui Streets for Susman & Cohen, 292 Ontario Street. The contract for steel sash has been let to the Trussed Concrete Steel Company of Canada, Limited, 23 Jordan Street, Toronto, the contract for reinforcing steel to Dalton & Sons, Princess Street, and the plumbing contract to Simmons Bros., 132 Princess St. Contracts for the installation of vault doors and elevator still to be let.

Montreal, Que.
Work has been commenced on the erection of an addition to the factory of Robin Bros., 131 Carriere Street. The general contract has been let to J. E. Robin, 589 Ninth Avenue, Rosemount Ward. Brick and fireproof construction, concrete foundation.

Archambault & Company, 332 Bleury Street, have commenced the erection of a factory for the Mount Royal Color & Varnish Company, Limited, 19 Dorchester Street E., estimated to cost $20,000. Concrete and mill construction, felt and gravel roofing, concrete floors.

Montreal, Que.
The following contracts have been let by the City Council for the erection of shops and a storeroom at Rachel and Baldwin Streets:—structural steel, Dominion Bridge Company, Lachine; roofing, N. Dinelle, 1096 Henri Julien Avenue; mill work, Isaac Allard, 1360 Des Erables Street; prism glass, Hobbs Manufacturing Company, 43 St. Maurice Street; elevator, Cote Bros. & Burritt, 46 Cone Street.

Niagara Falls Centre, Ont.
Work has been started on the erection of a concrete grain elevator for the Canadian Shredded Wheat Company by the Monarch Engineering Company, Buffalo, N. Y. Steel and reinforced concrete construction.

Norwich, Ont.
The contract for roofing at the premises in course of erection for Molson's Bank, 200 St. James Street, Montreal, has been let to the Brown-Jarvis Roofing Company, 9 George Street, Brantford, and for plastering and plumbing to the general contractors, McKinney Lumber Company, Ingersoll Avenue, Woodstock.

Ottawa, Ont.
The contract for masonry in connection with the stores being built by W. H. Lister, 127 Second Avenue, has been let to T. C. James, Flora Street, and for steelwork to the Dominion Bridge Company, Sparks Street. Other trades not yet awarded. Approximate cost, $20,000.

Point Grey, B.C.
The following subcontracts have been let in connection with the garage and stable in course of erection for B. T. Rogers, 1531 Davie Street:—sheet metal work, British Columbia Ceiling and Roofing Company, Seventh Street, Vancouver; glazed tile, W. N. O'Neil Company, Limited, 550 Seymour Street, Vancouver; reinforcing steel, Balfour, Guthrie & Company, 739 Hastings Street W.; electrical work, C. H. E. Williams, 509 Richards Street, Vancouver.

Princeville, Que.
The general contract for the erection of a slaughter house for the Co-Operative Abattoir Company has been let to J. H. Levasseur, Victoriaville. Estimated cost, $12,000.

Quebec, Que.
Work has been commenced on alterations to a shoe factory for Louis Beaubien, 124-130 St. Dominique Street. The contract for masonry, carpentry and steel work has been let to Jinchereau & Lamonde, 325 Richardson Street. Approximate cost, $8,000.

St. John, N.B.
The contract for electrical work at the stores being built for Scovil Bros., Limited, King Street, has been awarded to Frank Jones, Prince William Street.

Vancouver, B.C.
In connection with the bank and office building now in course of erection at Pender and Main Streets for the Canadian Bank of Commerce, the plumbing and heating contracts have been let to E. A. Bailey, 536 Helmcken Street, the contract for reinforcing steel and cement to Evans, Coleman & Evans, 407 Granville Street, and for hardwood finish to Chalmers Cabinet Works, 1424 Charles Street.

Walkerville, Ont.
The general contract for the erection of farm buildings for Walker & Sons, has been let to Wesley J. Link, Talbot St., Leamington. Frame and white brick construction, shingle roofing. Estimated cost, $20,000.

Residences

Arran Township, Ont.
W. Vance, Concession 4, Arran, Tara, Ont., is building a residence estimated to cost $3,000. Frame and white brick construction, concrete and stone foundation, shingle roofing.

Brantford, Ont.
A permit for the erection of a brick residence has been issued to Alexander J. Cromar, 341 Colborne Street.

Brigden, Ont.
Work has commenced by Carl Smith on the erection of a residence, estimated to cost $3,500. White brick construction, concrete and stone foundation, shingle roofing.

Camrose, Alta.
Tenders on the erection of a residence will be received until September 15th by Frank Hall. Frame construction, concrete foundation, felt and gravel roofing. Architects, Magoon & MacDonald, 604 Tegler Block, Edmonton. Approximate cost, $4,000.

Essex Camp, Ont.
W. T. Conklin, Kingsville, is about to erect two summer residences, estimated to cost $4,000. Frame and construction, shingle roofing.

Harriston, Ont.
J. C. Allan contemplates the erection of a residence on Arthur Street and the renovation of an existing house, at an approximate total cost of $6,000.

Kingston, Ont.
The erection of a residence is being considered by E. R. Beckwith, Cooper Street. Concrete and stucco or hollow tile construction, concrete floors, asbestos or asphalt roofing.

Listowel, Ont.
W. F. Brisbin, Harriston, is erecting a brick residence. Estimated cost, $3,000.

Montreal, Que.
A permit for the erection of three flats on Lajeunesse Street has been issued to H. Aubertin, 76 Fourth Avenue, Viauville. Approximate cost, $3,000.

Ottawa, Ont.
A. E. Shaver, 45 Powell Avenue, contemplates the erection of a residence on Findlay Street, at an approximate cost of $5,000. Stucco and brick construction, concrete foundation, shingle roofing.

Work has been commenced by B. A. Grison, 89 Fentiman Street, on the erection of a residence, estimated to cost $3,500. Stucco construction, shingle roofing.

(Continued on page 53)

Tenders and For Sale Department

TENDERS

Sealed tenders will be received by the undersigned, up to noon on **10th day of September, 1915**, for the construction of about 2,300 sq. yds. of concrete roadway in the Town of Simcoe. Plans and specifications can be seen at the office of the Engineer or Town Clerk. The lowest or any tender not necessarily accepted.

CHAS. E. INNES, Esq.,
Board of Works.

Simcoe, September 1st, 1915. 36

Tenders for Barn at Men's Industrial Farm

Bulk tenders only for all trades required in connection with work on the above will be received by registered post only, addressed to the undersigned, up to noon on **Tuesday, September 14th, 1915.**

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman Board of Control.

36

NAVAL SERVICE OF CANADA

Sale by Tender of C. G. S. "Lady of The Lake."

Sealed tenders addressed to the undersigned and accompanied by a certified cheque for Two Hundred Dollars ($200) will be received up to noon on **Thursday, the 7th day of October, 1915**, for the purchase of the Canadian Government Steamer "Lady of the Lake," lately employed in Fishery Patrol duties on Lake Winnipeg and now lying at the Government Wharf, Selkirk, Man.

The dimensions of the steamer, which was built in 1897 are:—Length 105, Breadth 18 feet, 5 inches, and depth 8 feet 9 inches. Her gross tonnage is 201 tons and her net tonnage 155 tons. She is fitted with steeple compound engines, cylinders 11 inches and 19 inches diameter, 15 inch stroke and a locomotive type boiler.

Form of tender, conditions of sale, full particulars of the Steamer, and permission to inspect her may be obtained on application from the undersigned or from the Inspector of Fisheries, Selkirk, Man.

Unauthorized publication of this advertisement will not be paid for.

G. J. DESBARATS,
Deputy Minister of the Naval Service.

Department of the Naval Service.
Ottawa, August 31st, 1915.
84903— 36-37

For Sale

The machinery and equipment of the Chatham Electric light plant, consisting of:—

2 Hornsby-Stockport horizontal gas engines, 100 h.p. each.

2 Hornsby-Stockport suction gas producers complete with scrubbers.

1 Hornsby-Stockport gasoline driven air compressor with air tank.

3 Western Electric d.c. generators, 3300 v., 8 amp., 50 light each.

1 Sheldon's Ventilating Fan No. 7.

50 Adams-Bagnall 8 amp. d.c. series arc lamps.

Offers will be received for the complete plant or any part thereof.

F. P. ADAMS, City Engineer,
Chatham, Ont.

36-37

Contractors Plant For Sale

The Corporation of the City of Victoria, B. C., have a large quantity of contractors' plant for sale, consisting of dinkey engines, dump cars, about 450 tons of 20-lb. rail, hand cars, hoisting engine, pipe, etc. A complete list of the above equipment, and any further information may be obtained upon application to the office of the City Purchasing Agent, City Hall, Victoria, B. C.

Victoria, B.C., August 27th, 1915. 36-38

SITUATIONS VACANT

WANTED

A superintendent for construction of a good class of buildings. State age, education and experience. Apply Box 231, Contract Record, Toronto. 36

Miscellaneous

Flesherton, Ont.
F. G. Karstedt is considering drilling for oil, and may be in the market for oil pumping equipment.

St. Casimir East, Que.
The Municipal Council are considering the purchase of one sucking pump and 1,000 feet of fire hose. Secretary, N. Carignan.

Late News Items

Drumheller, Alta.
The following contracts for waterworks supplies and construction have been let by the Town Council:—general construction contract, E. R. Leverton, 1919 25th Street W., Calgary, at $5,170; tank and housing, Vancouver Wood Pipe & Tank Company, 319 Pender Street W., Vancouver; pump and valves, Canadian Western Foundry & Supply Company, Calgary; boiler, etc., E. Leonard & Sons, Limited, 7 Lingham Block, Calgary; hydrants, Empire Waterworks Supply Company, Limited, Winnipeg; steel pipe and specials, General Supplies Limited 122 11th Avenue W., Calgary.

Lachine, Que.
The general contract for the erection of No. 4 Fire Station in the Fourth Ward has been let by the City Council to Fournier & Company, Limited, Second Avenue, at $17.980.

A contract for bitulithic paving has been let by the City Council to the Bitulithic Paving Company, 745 St. Catherine Street W., at $21,000.

Laval Des Rapids, Que.
The contract for plastering at the Novitiate in course of erection for the Cristion Brothers, 44 Cote Street, Montreal, has been let to P. Dansereau, 81 Knox Street, and for painting to A. Craig, 41 Jurors Street.

Montreal, Que.
The contract for the installation of seating at the theatre being built on St. Davis Street for the St. Denis Theatre Company, Limited, 160 St. James Street, has been awarded to the American Seating Company, New York City.

In connection with the school being built on Marie Anne Street for the Commissioners of St. Gregoire Le Thaumaturge, the plastering contract has been let to Pascal Lalot.

Pointe-aux-Trembles, Que.
The following contracts have been let by the Municipal Council for work at the shoe factory in course of erection on Lagauchetiere Street:-machinery, United Machinery Company of Canada; elevator, Otis Fensom Elevator Company, Limited, 368 St. James Street; electrical work, R. H. Gates, 186 St. Catherine St., Maisonneuve. Heating and plumbing will be done by day labor.

Sandwich West Township, Ont.
The contract for the erection of two steel and concrete bridges has been let by the Township Council to Ernest Renaud, Sandwich, Ont.

St. Catharines, Ont.
The carpentry contract in connection with the stores in course of erection in Queen Street for the Nash Realty Company, St. Paul Street, has been awarded to Nunamaker & Park, 5 Dufferin Street, and the plumbing contract to O'Gorman & Hemphill, 39 Geneva Street.

Winnipeg, Man.
The J. W. McDirmid Company, Limited, Canada Building, Winnipeg, have been awarded a contract for work on the Parliament Buildings on a basis of 5 per cent. on their actual outlay for labor and material, with free use of all plant and machinery required. During the winter public tenders will be called for the completion of the buildings, and work will start with the beginning of the building season next year.

Residences

(Continued from page 51)

W. H. George, architect, Castle Building, Queen Street, has prepared plans for two residences to be built on Marlboro Street for Barrett Bros., 260 Catherine Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $9,000.

Henry Bildo, 116 Pamilla Street, has commenced the erection of a residence on Bell Street. Brick veneer construction, stone foundation, felt and gravel roofing. Estimated cost, $3,500.

D. L. Campbell, 6 Driveway West, is about to erect a residence on Wilton Crescent, at an approximate cost of $6,000. Stucco and brick veneer construction, stone foundation, shingle roofing.

Outremont, Que.
J. E. Wilder, 41 Mayor Street, has commenced the erection of a cottage on Hartland Street, estimated to cost $6,500.

Leon Beauchamp has started work on alterations to his cottage at 87 McCulloch Avenue. Approximate cost, $3,000.

Plans have been prepared for a cottage to be built on Outremont Avenue by A. Chenevert, 108 Delorimier Ave. Approximate cost, $8,000.

Quebec, Que.
Joseph Drolet, 184 St. Sauveur Street, has commenced the erection of a residence on Third Avenue, Limoilou, estimated to cost $3,000. Brick and frame construction, concrete foundation, metal and asbestos roofing.

Sarnia, Ont.
Robert W. Fawcett, 152 Tssex Street, is preparing plans of a bungalow for Joseph Peterson.

St. John, N.B.
Permits for the erection of residences have been issued to the following:—Armstrong & Bruce, 167 Prince William Street, $3,600, frame construction; Miss Agnes Barbour, 256 St. James Street, $3,000, frame construction; Fracis Kerr, 153 Adelaide Street, $3,000, concrete construction; E. Perry, Clarendon Street, $3,500, frame; Moses Simon, Lansdowne Avenue, $3,000, frame.

St. Marys, Ont.
The erection of a residence is contemplated by B. W. Bugbee, Driller, West Ward. Approximate cost, $3,200.

The erection of a residence on Queen Street is contemplated by T. J. Stillman, Opera House Block. Estimated cost, $3,500.

Toronto, Ont.
S. B. Green, 50 Annette Street, has commenced the erection of the first of five residences to be built on High Park Avenue and Conduit Street. Stone and brick construction. Approximate cost, $4,500 each. Smaller trades will be let.

Plans have been drawn for a residence to be built on Conduit Street by S. B. Green, 650 Annette Street, at an estimated cost of $4,300. Smaller trades will be let. Stone and brick construction.

W. A. Scott, 145 Mutual Street, has commenced the erection of a residence at MacLean Street and Crown Park Boulevard. Smaller trades will be let. Brick construction. Approximate cost, $4,000.

Work has been started by R. Liddell, 155 Lippincott Street, on the erection of a pair of residences estimated to cost $4,800. Smaller trades will be let. Brick construction.

CONTRACTS AWARDED

Aylmer, Que.
Chas. Magee, Union Bank Building, Ottawa, has let the contract for rebuilding his cottage to J. Bratton, 86 Florence Street, Ottawa. Contractor has not yet purchased supplies.

Bowmanville, Ont.
A. Pennington, Concession Street, has commenced the erection of a residence for W. A. Allen.

Dashwood, Ont.
Work has been started by Louis Weber, Zurich, on the erection of a residence for David Tieman. Frame and white brick construction, stone and concrete foundation, shingle roofing. Approximate cost, $3,000.

Hamilton, Ont.
In connection with the three residences being built by William Atkinson, 59 Cedar Avenue, the masonry contract has been awarded to Smith Bros., Norway Avenue. Brich construction, concrete foundation. Estimated cost, $,400.

Leamington, Ont.
The general contract for the erection of a residence for G. A. Campbell has been let to H. Foster. White brick construction, concrete and stone foundation, shingle roofing. Estimated cost, $4,000.

Maidstone, Ont.
Bethel Croft is building a residence for William Hayes, estimated to cost $3,000. Frame and white brick veneer construction, shingle roofing

Montreal, Que
The following contracts have been let in connection with the residences being built by W. Irving, 26a Stanley Street, for S. B. White, 906 Comte Street:—masonry and plastering, general contractor; mill work, R. MacFarlane & Company, Ltd., St. James Street; cut stone, J. Quinlan & ompany, 4412 St. Catherine Street, Westmount; heating and plumbing, J. Colford, 456 Guy St.; electrical work, Charles Gamble, 93 Fulford Street; tiling, R. Mitchell Company, Ltd., 27 McGill College Avenue. Painting and roofing not yet awarded.

Niagara Falls, Ont.
The contract for heating and plumbing at the residence of John Dawson, Queen Street, has been let to Tremble & Ssalee, 66 Queen Street, and for electrical work to Niagara Electric Company, Victoria Avenue, Niagara Falls.

Ottawa, Ont.
J. R. Rady, 428 Lisgar Street, has let the contract for heating and plumbing at the residence being built by him on Fairbank Street to F. Gervin, Bank and Sunnyside Streets.

The contract for heating and plumbing at the residence being built on Findlay Street for A. E. Shaver, 45 Powell Avenue, has been let to J. P. Band, Bank Street. Electrical work will be done by owner.

William Ryder, 15 Maple Street, has commenced the erection of a residence on Ossington Street for Joseph Meghan, 26 Westmount Avenue. Estimated cost, $4,800.

Samuel Brooks, 69 Union Street, has commenced the erection of a residence on Creighton Street, estimated to cost $4,500. The contract for plastering has been let to Brooks & Davis, Union St.

Outremont, Que.
The following contracts have been let in connection with the cottage being built by Amede Chartrand, 611 City Hall Avenue, for J. H. Lemieux, 116 Laval Avenue:—stone, masonry and carpentry, general contractor; brick work, A. P. Paquette, 277 DeLanaudiere Street; roofing, heating, plumbing and electrical work, A. Pageau, c/o general contractor; plastering, O. Houle, 577 Droler Street. Painting and glazing by day labor.

Quebec, Que.
In connection with the residence being built on Charlesbourg Road by A. Letarte, 386 Richardson Street, the contract for masonry has been let to T. Giroux, Beauport Street, and for carpentry to Bernier & Boulet, 24 Lamontagne Avenue, Domaine Lairet, Quebec.

Stratford, Ont.
The following contracts have been let for the erection of a residence on Water Street for Henry Kalbfleisch, Erie and St. Patrick Streets:—masonry, Everett & Marson, Erie and Chestnut Streets; carpentry and roofing, Kalbfieisch & Armbrust, Gore and Home Streets; plastering, W. Soeder, Huron Street; painting, A. E. Cash, Ontario Street; heating and plumbing, Peter & Sylvester, Ontario Street; electrical work, F. C. Whatmough, St. Vincent Street. Approximate cost, $4,000.

Toronto, Ont.
The contract for masonry in connection with the residence being erected at 26 Oakmount Avenue by S. B. Green, 50 Annette Street, has been let to Turner Bros., 14 Gillespie Avenue.

The contract for masonry in connection with alterations and additions to the residence of S. Frank Wilson at 5 Dale Avenue has been awarded to Smallwood Bros., 97 Clinton Street. Approximate cost of work, $6,000.

Walkerville, Ont.
W. McCrae has commenced the erection of three bungalows for R. A. Holland, Assumption Street. Stucco and frame construction, concrete foundation, shingle roofing. Approximate cost, $4,500 each.

Westmount, Que.
The contract for tile and marble work at the residence being built on Western Avenue for A. Letang, 4289 Western Avenue, has been let to Robert Mitchell Company, Ltd., 27 McGill College Ave.

Windsor, Ont.
T. C. Ray, 105 Victoria Avenue, has let the following contracts for the erection of a residence on Dougal Street:—masonry, Cross Bros., 25 Louis Avenue; carpentry and roofing, W. Thornton, Sandwich Street E.; plastering, N. Troup; painting, J. Summer; heating and plumbing, T. Blackburn, Pitt Street E.; electrical work, A. Cook, Albert St. Approximate cost, $3,500.

Power Plants, Electricity and Telephones

Crediton, Ont.
The Village Council are considering the installation of a power distribution and lighting system. Clerk, S. Brown.

Granton, Ont.
The Town Council propose to install a hydro electric system at a cost of approximately $5,000. Clerk, W. D. Stanley.

Thornfield, Sask.
The Thornfield Rural Telephone Company have been empowered to borrow $4,600 for the construction of their system. Secretary, E. E. Hamderson, Venn.

CONTRACTS AWARDED

Hull, Que.
The general contract for the construction of a hydro-electric plant has been let by the City Council to the Canadian General Electric Company, 23 Sparks Street, Ottawa, at $34,840. Works include power house, draft tube, open flume and flume gates. The building contract has been sub-let to E. R. Bisson, Montcalm Street.

Fires

Arnprior, Ont.
Fire has destroyed the lumber yards of James McCreary sr. Loss, $12,000, including about $2,000 on buildings.

Cherry River, Que.
Leslie Buzzell's creamery has been completely destroyed by fire.

Cobalt, Ont.
Fire has destroyed the Empire Theatre, the property of A. Giachino, Cobalt. Loss, $3,000, insurance $2,000.

Cookshire, Que.
The chemical plant of the Standard Chemical, Iron & Lumber Company has been totally destroyed by fire. Loss unknown.

Dundas, Ont.
Fire has destroyed a residence on McNab Street, belonging to Thomas E. Wood. Loss, $3,000, mostly covered by insurance.

Emo, Ont.
Fire has totally destroyed the residence of Malcolm Gillies. Insurance very small.

Frankford, Ont.
Fred Spencer's garage has been destroyed by fire. Loss, $6,000 to $7,000.

Hamilton, Ont.
Fire has destroyed a residence in course of erection on Freeman Place for R. M. Allworth, 75 Hughson Street N. Loss, $10,000.

Hebron, N.S.
Fire has totally destroyed the residence of Knowles E. Crosby.

Inwood, Ont.
Fire has totally destroyed Hugh Johnston's barn. Loss unknown.

Montreal, Que.
Fire has destroyed the office building and warerooms at 185-187 Wellington Street owned by the James Robertson Company, Ltd., 142 William Street. Loss, $50,000.

Fire has destroyed the grandstand at the Blue Bonnets Race Track, the property of the Montreal Jockey Club. Loss on stand, $50,000, fully insured; damage to clubhouse and pari-mutuel building, $4,000. Secretary, W. Northey, 11 St. Sacrement Street.

New Hamburg, Ont.
Fire has destroyed the factory of the electric Meter & Stamping Company, Waterloo Street. Loss between $30,000 and $40,000, partially covered by insurance. Manager, John Messner.

North Bay, Ont.
A store house belonging to C. Sandrelli has been completely destroyed by fire. Loss unknown.

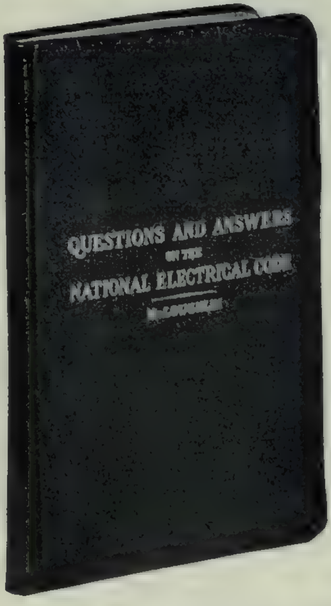
Pembroke, Ont.
Fire has destroyed an ice house and stable, the property of T. A. Sammon, Copeland House. Loss, $4,000, covered by insurance.

The planing mill of the Hardwood Specialties Company has been destroyed by fire. Loss, $45,000, covered by insurance. The company will rebuild.

Revelstoke, B. C.
Sawyer Bros.' lumber mill has been destroyed by fire. Loss, $6,000, insurance, $3,000.

Rideau Lake, Ont.
Fire ras destroyed the Angler's Hotel, owned by I. G. Ogden, 457 MacKay St., Montreal. Loss, about $12,000.

Wallaceburg, Ont.
David Campbell's store on Wallace St. has been gutted by fire.



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Insurance of Office Tenure

IN another column of this issue will be found a letter from Mr. John W. B. Blackman, City Engineer of New Westminster, dealing with the matter of civic officials taking out insurance policies against the possibility of the loss of an appointment through the arbitrary action of the municipal authority.

During recent months there have been several instances of officials who have for years faithfully served their cities only to find that when age and external conditions were unfavorable they were cast adrift. Some of these cases are flagrant misuse of political powers and there is no redress. If the officials had means of insuring themselves against the loss of office—in other words, the insurance of tenure of office—as Mr. Blackman now proposes, they would at least have the consolation of being able to provide themselves with a fund to enable them to live in reasonable comfort pending another appointment.

Mr. Blackman's proposition has been discussed for a long time in Great Britain and the outcome of the discussion has been the formation of a company to accept risks such as loss of office. It is now suggested that a similar organization be established in North America.

Old Country conditions are not similar to those in North America. There, officials hold office for long periods and the fact of any of them being unfairly dealt with causes a considerable flood of discussion, sympathy and criticism. In North America a very small proportion of the officials have had a long tenure of office, and when changes are made they do not attract much attention outside the immediate locality. This, however, does not detract from the value of the scheme, because if politics do play a bigger part in municipal affairs in this country, it is all the more reason why conscientious officials should be protected. It is nevertheless important to consider the conditions of service in this country so as to judge of the feasibility of an insurance scheme. What, for example, would be done for the official who is not removed from office but has had his salary greatly reduced? Or in the case of reconstitution of local government, where say, commission form displaces the ordinary council and that entails the re-casting of the official roll?

Assuming that all such disturbances can be provided for in this scheme, the premiums would for a time have to be tentative. It could no doubt be arranged that the members would each bear a financial burden by means of an assessment, as is done by some friendly or fraternal societies, when a call is made for which there are insufficient funds. This is a matter that could be ascertained and adjusted by experience alone, and those starting such a mutual insurance fund would have to be satisfied to commence business with this knowledge and arrange with some recognized, powerful guarantee company to underwrite the risks to some extent.

It will be necessary to define what is meant by arbitrary or unjust dismissal. We are raising these points so as to induce a lively discussion, for it is only by the cordial exchange of thought and ideas and by mutual co-operation that public officials can hope to protect themselves. Will age or infirmity of any kind constitute a reasonable ground for dismissal? If for some unforeseen circumstance any work costs more than the original estimate, will this suffice as a reason for discharge?

The insurance fund will, of course, be available for all classes of public officials and in that respect if a large number should combine to establish the fund it would immeasurably increase the security of their fund against loss. In a large country like Canada it may be difficult to induce officials in the east and west and central parts to join, but ultimately that may be overcome by judicious organization.

Assuming that the rate of insurance suggested by Mr. Blackman will suffice, then in the example he has worked out an official drawing an annual salary of $2,000 could insure for a maximum sum of $4,000, and would pay at the rate of one-quarter per cent., or 2½ mills on the dollar. In this case it would be $10 per annum. But to assure that there would be no change in the terms by the guarantee company at the end of the year the insurer in his own interest would insure for, say, three years, and by so doing would probably obtain a five per cent. discount on the premiums for the second and third years. In view of the small cost of insurance of office tenure it would appear reasonable to expect the officials to accept the offer without hesitation, for without insurance he would draw $2,000 a year and carry the risks himself, as compared with drawing $1,990 per annum without risks of loss and their attendant worries.

With regard to the second idea of insurance against libel and slander: this risk it is suggested can be arranged in a similar manner. The law of libel and slander in this land, however, is far from being satisfactory. We are accustomed to hear all manner of accusations, and some become inured or case-hardened. This is most detrimental to public service, and whether a scheme of insurance will tend to make some accusers careful or make some officials more callous, it is difficult to judge.

There is a great deal to be stated in favor of this scheme, but the tone of public sentiment must change in regard to the abuse of character ere we can see hope of improvement in this respect. Our columns are open to free discussion of the entertaining and valuable suggestions made by Mr. Blackman.

The Responsibility for Inspection

ONE'S attention is drawn to the position of responsibility of the architect or engineer in relation to his client, by several recent decisions of the courts in which heavy damages have been awarded the client against the architect for faulty work on the part of the contractor. One can hardly question the correctness of the attitude of the courts in regard to this matter. While the architect may feel that there is a large element of injustice in holding him responsible for another's work, it must be conceded that the court is in a much better position to take an impartial attitude than an architect or engineer can be. Quite naturally, when a man retains an architect to look after his interests, and pays him a fee for this purpose which to the client nearly always seems a large one, and the results are not satisfactory, the architect is the one whom the client holds responsible; and certainly it is the duty of the architect to do everything possible to ensure that the work on the building shall be done properly.

It becomes necessary, then, for the architect, in order to protect himself from liability for damages, to take such steps as are necessary to obtain satisfactory construction. First, he must make certain that the plans and specifications have not been prepared by anyone except a man who he knows is competent. Most of the recent actions for damages have been in cases of reinforced concrete buildings. An architect is taking a great risk in having concrete or steel framing plans prepared by any one except a man who he knows is competent to do such work. However, it is in the construction rather than in the design of such buildings that the fault has lain; and generally the architect has been blameworthy only because, through his neglecting to give proper inspection, the contractor has been allowed too much latitude in his work.

It devolves upon the architect or engineer, therefore, to employ such means of looking after the work that it will be impossible for even a dishonest contractor to do his work improperly. In the case of ordinary construction, the general supervision as ordinarily given by the architect should prove sufficient. Nearly all the materials, such as stone, brick, lumber, and so forth, are either natural products or are manufactured before being brought to the building, and their quality can be ascertained by an ordinary examination. The quality of the workmanship also can be determined fairly well by an inspection after the work is done. In the case of steel work, the architect is not taking any very big chances by not having the steel inspected at the rolling mills. The manufacturers aim to make a steel of uniform quality; and, while some rollings do not come within the limits of their standard, they vary so little from them that even the poorest steel rolled into structural shapes is quite good enough for use in ordinary structures. In larger and more important buildings, however, the steel should be inspected at the rolling mills, in the fabricating shops, and on the building.

In the case of concrete, both plain and reinforced, which has become so important in construction in recent years, the material is manufactured from its ingredients right on the work. The quality of the sand and stone can be determined by ordinary observation. The quality of the cement can be determined only by laboratory tests. While the cement manufacturers, like the steel manufacturers, aim to make a standard material, they are not always so successful in coming within or close to the limits of their standard. Some of the cement turned out by factories is quite unfit for use; so that in all but the most unimportant work the cement should be tested.

Concrete is made in small batches, there being perhaps several thousand in an ordinary-sized building. Any single batch, improperly mixed, could cause the collapse of a portion of the building. These batches are mixed and made by laborers who know nothing of the importance of having the proper proportions of ingredients. It is imperative, therefore, that a man be constantly at the machine to see that each batch is accurately proportioned and mixed. It is imperative also that a man be on the building where the concrete is being placed to see that the forms are constructed properly; that all dirt is kept cleaned off the forms and previously poured concrete; that the steel is properly placed and secured; that the concrete is puddled properly into the forms and around the steel—in short, to see that the concrete columns and beams are fabricated in an efficient manner.

It is evident that such inspection as this is quite outside the work meant by the term "supervision" as used by architects and engineers. Since it is extra work occasioned by the use of a special material, and work that would not be required by the ordinary forms of construction on which the scale of architects' fees has been based, it should be paid for by the owner.

In the case of inspection of steel work, it is the practice of some architects to specify that the steel contractor shall pay the cost of the steel inspection, and to appoint one of the inspection companies to do the inspection. This could be done in the case of concrete construction also. The more satisfactory way, however, would be to make an addition to the regular commission, explaining to the owner why it is made and the necessity for it. In most cases an addition of one per cent. to the ordinary commission will be more than sufficient to cover the cost of such services.

If, in spite of this most careful provision for inspection, the building turns out to be faulty, and the design is correct, it must be on account, not only of dishonesty on the part of the contractor, but also of dishonesty, or negligence on the part of the architect's own employees.—Cement World.

Can We Increase the Volume of Engineering Construction in Winter?

WINTER in all northern latitudes is the slack season of engineering construction. The "construction season" closes with the first inclement weather of the fall. Until spring, man, plant and capital are idle or merely mark time. There are exceptions to general practice and they are important to note because they make clear the fact that it is habit and custom that have as much to do with the slackening of engineering operations in winter as does the inclemency of the weather. These in a few words, says Engineering and Contracting editorially, are the conclusions of a committee of the Oregon Society of Engineers, which has been investigating winter unemployment in engineering construction. On the whole, the committee says finally, winter work is quite as economical for the taxpayer as that done in the summer season.

In making this claim of economy the conditions in the mind of the committee were those of the mild winter climate of the north Pacific coast. It is proper to allow for these conditions, but there are many northern latitudes where similar or not much more severe winter climate prevails and where winter work is equally feasible. Except in the most severe northern climate construction work is not prohibited by storm and frost for a season of three or four months. There are, in fact, not many days when the weather makes construction operations impossible. Cold makes these operations physically more difficult without doubt, and normally increased difficulties mean increased cost. Other things being equal, a yard of concrete cannot be placed or a yard of earth cannot be excavated with as little labor in cold weather as it can be done in warm weather. Does, however, a yard of concrete or of excavation necessarily cost more in cold than in warm weather?

The Oregon Society committee presents reasons for a negative answer to this question. In winter good labor is more plentiful since many high class men ordinarily busy in summer are looking for work. The contractor by winter work holds his organization together, doing profitable work instead of killing time. Finally, capital and plant are both producing instead of lying idle. These are economic advantages that help to counterbalance extra cost due to any greater difficulty of cold weather construction. For the community there are the further economic advantages of not having a large number of men idle during several months and of not having capital tied up so long in construction operations.

LETTERS

Security of Tenure

Editor, The Contract Record:

I am desirous of taking up with you and your readers the matter of security of tenure, knowing that your paper has always given publicity to any measures calculated to promote protection for civic employees.

I should like to get an expression of opinion from all heads of departments throughout Canada as to either forming an Insurance for Security of Tenure or a Mutual Defence Fund, and having the record of sufficient names to present to an insurance company so that policies could be issued. The scheme has been worked out successfully in Great Britain, and there is no reason why Canada and the United States should not follow suit.

There is not a city official who would not like to feel that by taking out a policy he could be secured against the loss of office by the arbitrary action of his employers, with protection against slander and persecution, whilst carrying out his duties without fear or favour, or the risk of vindictive attacks by influential persons with whom he may have come in contact whilst carrying out public duties.

Cases of unjust dismissal are happily few and this should make the risk small and justify low premiums. I feel sure that with the co-operation of all civic employees a sufficient number could be enlisted, so that taking the annual premium of a large number, an insurance or guarantee company would after investigation organize a branch called "The Security of Tenure Branch" with a .25 per cent. premium on a scale as follows: a policy to be issued for two-thirds of three years' salary in case of loss of office otherwise than misconduct, the maximum policy to be, say, $15,000, i. e., two-thirds of three years' salary.

Example.—An official with a salary of, say, $2,000 per annum can insure for a maximum of $4,000 (two-thirds of three years' salary) and should be able to arrange for a discount on the second and third years' premiums.

.25 per cent. on the 1st year's premium	$10.00
2nd year's premium paid in advance, say, 5 per cent. less	9.50
For two years	$19.50

Arrangements could be made for policies up to five years to be renewed if the insured still held office. Separate arrangements could be made with officers working under a superannuation scheme.

Another policy for the protection against libel and slander up to a sum of, say, $3,000 at .25 per cent. should be undertaken.

I have had correspondence with a few officials, who, while they think the scheme an excellent one, do not think it can be worked out. I feel confident that it can be worked out and if an expression of opinion were sent to The Contract Record from all willing to join the scheme, an insurance company could be approached and business commenced. It is time municipal officials got together to protect their interests in some way or other.

Engineers, who are the chief spending officials, should be protected from official worry. It is worry that kills. Security would increase efficiency, improve health and lengthen life. The scheme should appeal both to the employer and to the employee as a means of improving the status of every public official.

Yours faithfully,
J. W. B. BLACKMAN.
New Westminster, B. C., Sept. 8th, 1915.

Patriotism in the Award of Contracts

Further discussion of the editorial article published under the above heading in our issue of Aug. 25th

Incompleteness of Plans and Specifications

Editor, The Contract Record:

We wish to congratulate you on your stand in the matter of the Regina contract. The Robert Simpson Company never had any intention of giving Canadian firms a chance to do the work. True, they asked us to give them a tender, but they must have known that this was impossible owing to the incompleteness of the plans and specifications. We were given only a few days to submit a figure, but even with adequate time it would have been impossible to have prepared a bid. In any case we were fully aware that the Simpson Company had already awarded the contract, as their representative was accompanied by a Mr. Purvis, who told the sub-contractors here that his firm already had the job. Mr. Purvis is now in charge of the work for his Chicago firm.

Yours truly,
SMITH BROS. & WILSON, LIMITED.
Regina, Sept. 8th, 1915.

* * *

Advertising Inefficiency

Editor, The Contract Record:

Your stand in the matter of the Simpson Company's award is very commendable. It seems to me, however, that the interests of the contracting community would be promoted more directly if other business men of the country, besides contractors, could be induced to take an interest in these matters.

The action of the Robert Simpson Company was unjustifiable. Go to any Canadian city, and you will find buildings designed by Canadian architects and built by Canadian contractors which compare favourably with any other of the same size and kind on the American continent. The proposed building at Regina does not offer any difficult engineering or contracting problems: it is just a plain, ordinary, reinforced concrete building of a type that we know by hundreds.

The unfortunate part about such an incident as this is that the world at large, knowing that engineers and contractors in this country are none too well employed at the present time, will feel that the Simpson Company must have considered them incapable of carrying out the work. The successful contractors, who are known to the writer, are a large, well-connected firm, but they have no special facilities in the way of money, men, or equipment which any good Canadian firm does not possess. No doubt they were anxious to get experience in this country, and the work at Regina afforded an excellent opportunity of familiarizing themselves with local conditions and acquiring information and data at the owner's expense. In this case the owner is not only paying for the expense of securing these data, but also he is paying a commission on the expense. The Chicago firm will probably send two or three men to Regina to start the work, and doubtless they will rent equipment from local contractors and machine companies, paying so much a day for the use of it. When the job is done it is more than likely that they will open an office in Regina, as by that time they will be in a position to bid intelligently on future work. The profits on their business in Canada will be sent to Chicago.

As far as the contracting business is concerned I am a free trader. Otherwise I believe that Canadian industries should be protected until they are better able to compete with outsiders. In the contracting business, however I am sure that given the opportunity our leading contractors can put up any kind of a building more expeditiously, more efficiently, and more cheaply than any outside firm. I do not know of any U. S. contracting firm that has secured work in this country during the last few years where Canadians had a fair and square opportunity of competing, and I am sure that had they had such opportunity in the present instance not a word of protest would have been forthcoming.

It is altogether too bad for Canadian concerns to sidetrack the Canadian constructional interests. It is telling the world that we are inefficient—and this is grossly untrue.

Yours truly,
A WINNIPEGER.
Winnipeg, September 11, 1915.

* * *

Saskatoon Firm's Viewpoint

Editor, The Contract Record:

The editorial leader in your issue of August 25th in my opinion adequately describes the feelings of all Canadian contractors in regard to the manner of letting the contract for the Robert Simpson Company's building in Regina. The indignation aroused among those in the building business by the unpatriotic policy of the Simpson Company will not soon wane.

The action of the Simpson Company in awarding a contract to anyone without open competition is in itself a violation of all the recognized rules and principles usually adhered to in the letting of contracts. The contracting business is primarily a competitive one, and the result of such competition is the assurance the owner has of getting the best material and workmanship at the lowest possible price. For this reason, therefore, doing away with the competitive system in construction work, just as in any other line of business, will ultimately result in a distinct economic loss to the vast multitude of people who are investing money directly or indirectly in the buildings and plants necessary for the successful operation of commercial enterprises.

In the case in question the loss to Canadian citizens through the fact that a United States firm has been handed the contract will also be considerable, for in all probability the profits earned on this work will not be reinvested in Canada. If the work had been awarded as the result of obtaining prices there is little doubt but that a Regina firm would have been awarded the contract. They in turn would have turned the business into home channels; they would have purchased Canadian material and employed Canadian foremen and skilled mechanics. This would have resulted in putting money to the extent of a great many thousand dollars, with all its accruing benefits, into circulation in that city.

The principal point at issue, however, if we are correctly informed, is that the Canadian contractor did not get a chance. There would be less cause for complaint if the United States firm had secured the contract by being the lowest responsible bidder. Under the circumstances it will no doubt be the policy of those adversely affected to do their share towards seeing that the Simpson Company's venture is attended by as little success as possible.

It is scarcely to be expected that anything will be offered by way of excuse, for since they lacked the desire to assist their fellow-countrymen at a period in our history so critical as the present, presumably it is too much to hope that they will be either conscious of their fault or amenable to reason.

Yours truly,
GEORGE T. CLARK.

Saskatoon, Sept. 6th, 1915.

* * *

Business Patriotism Makes for a Legacy of Higher Citizenship, says Well-Known Winnipeg Contractor

Editor, The Contract Record:

I have read with much interest in your issue of August 25 an editorial article regarding the award of Canadian contracts to United States firms.

Of course, the practice is rather common with the larger Canadian institutions, such as railways, banks, and so on, and after all these years it is interesting to find a paper patriotic enough to call attention to this very important matter.*

*The impression created by Mr. McDiarmid in this paragraph would hardly suggest the unfailing policy of this journal to further and protect the interests of Canadian contractors. The instances wherein we have urged that in fair competition, all other things being equal, Canadians should be given the preference in Canadian work are too numerous to mention.—Editor.

Strange to say, the worst offenders in this respect are the institutions, firms, or individuals who profit most by the high protection policy sanctioned by the Canadian people. Many are protected to the complete exclusion of foreign competition, but they seem to have no thought of Canadian development in return. This seems very inconsistent with their oft-repeated stories of suffering from foreign competition, and the infamous "dumping ground" theories so much in evidence when they wish to impress upon the Canadian people and the Canadian Government the need for further protection for their own special industries in order that they may be able to compete with legitimate or illegitimate foreign competition.

We are all more or less selfish, but as far as I know the Canadian building trades have never asked for protection against any foreign competition, nor have they made any public protest when those institutions unduly subsidized by Canadian money, lands, and guarantees have given every preference to the foreign contractor—often without asking a single Canadian to tender on work which has to be paid for by the Canadian people with Canadian money.

It is quite evident that we Canadians are lacking in that intense spirit of patriotism which is so much in evidence with our neighbors to the south—a spirit which has done so much for the development of their country, while we have achieved little, and certainly not enough to provide opportunities for many of our energetic sons who are contributing in no small degree to the upbuilding of the United States.

Generally, the American contractor employs an American staff, and makes use of such American equipment and material as he can—to the detriment of Canadian workmen and Canadian industries. He pays only a nominal tax, if any, and he invests his profits in his own country, doing nothing towards the development of ours. Should his work benefit his disloyal employer, it is at the expense of this country as a whole. The policy is penicious, shortsighted, unpatriotic, and unworthy of Canadian citizenship.

By contrast, imagine Marshall Field awarding the contract for a building to a Canadian firm without asking any United States firm for a tender, or because a Canadian firm had a lower tender. Whatever else might happen the whole of the United States press would have something disparaging to say about the transaction. If we Canadians wish to develop our own country we must be imbued with the patriotism—if in a modified form—so much in evidence across the boundary line. We must cultivate a national spirit; and though this be the day of small things we must not forget the greatness of our inheritance. We must remember that we are laying the foundations of Empire, bearing in mind that high national ideals have greater values than material successes.

To posterity we owe a legacy of higher citizenship. It is regrettable that this is not more in evidence in times when such great individual sacrifices are being made for the cause of Empire, and when the gallantry of our Canadian boys at the front is being achieved at such great cost.

Yours truly,
JAS. McDIARMID.

Winnipeg, September 10, 1915.

* * *

"Just as Much a 'Vital Consideration' in Times of Peace"

Editor, The Contract Record:

Your article "Patriotism in Awarding Contracts," published in your issue of August 25, calls for comment. In the first place we would say that we wish to be considered patriotic: we are cheerfully paying taxes and making contributions to the War Fund; we are putting war stamps on our mail rather than evade the tax by messenger delivery; we will help our country in every way we can.

On account of your introduction of the patriotic issue, an adverse criticism may be misunderstood: we must perforce keep silent or applaud anything which parades loyalty.

You speak of "wilfully ignoring the interests of one's own people." This is a matter of opinion. Usually it is declared treason only by opponents of a measure—particularly at elections. It is just as much a "vital consideration" in times of peace.

For some years Toronto has seen so much of what you complain that we have come to regard it as a reasonable expectation. Nearly all the large works here have been placed in the care of foreign firms by corporations, institutions, and commissions, the ruling spirits of which hold their loyal heads very high. We live among these happenings without taking any more notice of them and so we are inclined to think lightly of this one instance at Regina. In regard to materials, all our best buildings are equipped with a large amount of imported brick, terra-cotta, stone, marble, and bronze work fixtures. Little sympathy is excited for our dealers and manufacturers. Only too often the foreign contractor is given advantages on low grade articles which are denied our own people.

At the present time we have foreign materials in our yard for sale at prices which compete with home-made goods. This would not be so if our Canadian manufacturers would furnish us with the goods, but they prefer to check the sale, and on the smaller quantity live on the large customs tariff by which they are protected and which goes into their pockets. This compensates them for the amount of foreign material used.

We have seen evidence of an organization in Toronto which restrains us from handling some Canadian-made articles, and if The Robert Simpson Company are suffering an attack from the same interests they have our best wishes for success.

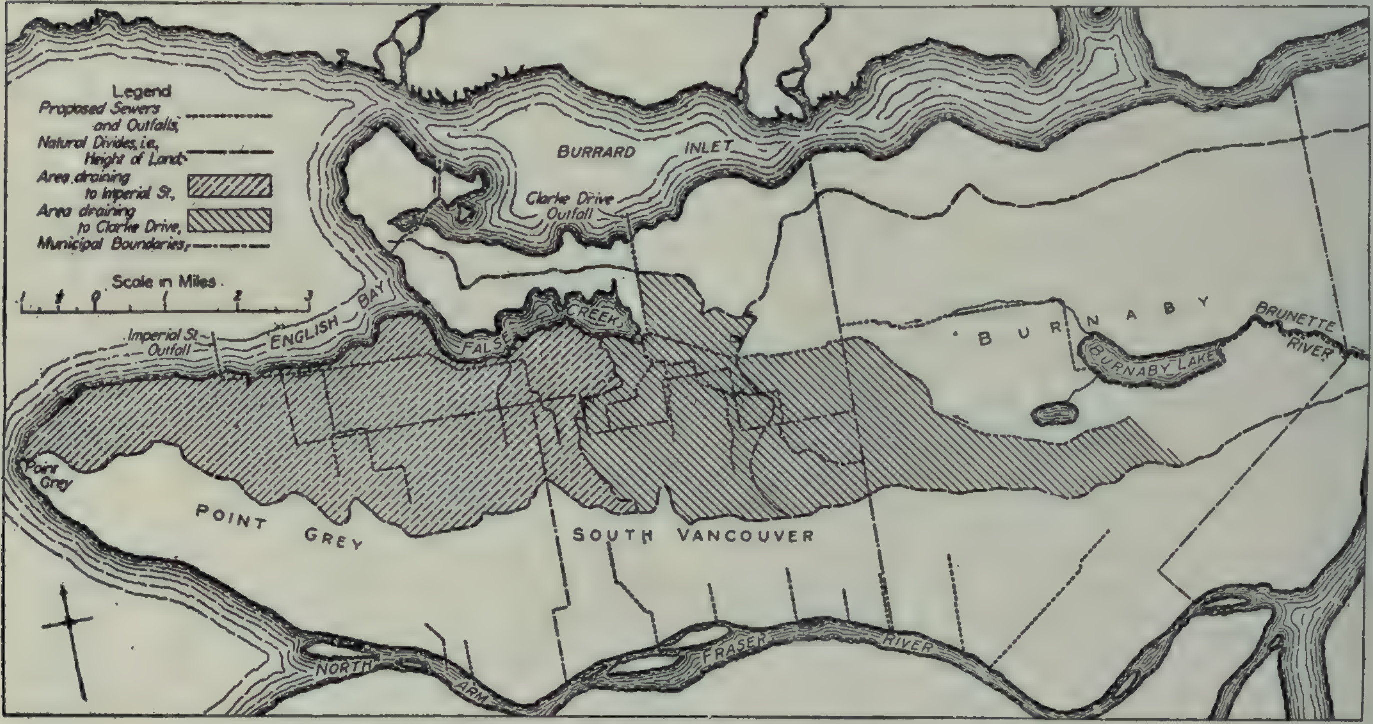
Yours truly,
T. CANNON & SON, Limited

Toronto, August 25, 1915.

Greater Vancouver Sewerage Scheme

Constructional and General Features of One of the Largest Undertakings of Its Kind on the American Continent—An Expenditure of Eleven Million Dollars Planned

THE Greater Vancouver Joint Sewerage Scheme, which will provide drainage and sewerage for the city of Vancouver and the municipalities of South Vancouver, Point Grey and Burnaby, is by far the most important project that has ever been undertaken in Western Canada. In point of magnitude it will compare with anything of a similar nature ever attempted on the American continent. It is estimated that the completed scheme, which is being carried out by the Vancouver and Districts Joint Sewerage and Drainage Board, will cost at least $11,000,000, and this only includes the great main trunks which will provide drainage and outlets for the systems which will have to be constructed by the various municipalities concerned, and which the engineers say will cost at least an equal amount. Half of this great amount will be spent in the first five years of construction. The other half will be utilized as extensions are called for—it is expected in the following twenty years.



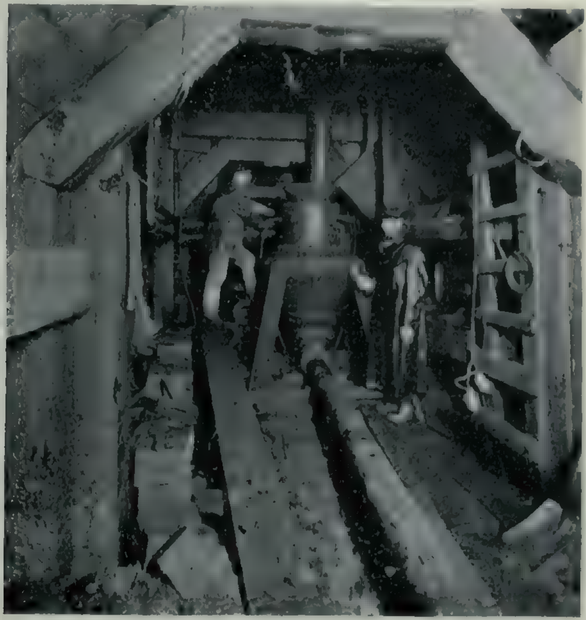
Plan of Burrard Peninsula, showing scheme of joint sewerage system for Greater Vancouver.

Early in 1911 a committee, composed of two representatives from each of the municipalities concerned, was organized, with instructions to take such steps as were considered necessary to work out a satisfactory scheme. The committee comprised H. H. Stevens (Chairman and S. J. Crowe, Vancouver; J. Dickinson and Donald Burgess, South Vancouver; A. N. Adams and S. G. Churchill, Point Grey; and Reeve Weart and A. Macdonald, Burnaby. In June of that year this committee engaged R. S. Lea, an eminent Montreal consulting engineer, to investigate and report on a suitable scheme, with the result that the present scheme, after nineteen months of careful investigation on the part of the engineer, in all its essential details, was adopted, and the great Burrard Peninsula Joint Sewerage System was inaugurated. In making his final report the engineer took occasion to remark on the wisdom and foresight shown by those who took the initiative in promoting the joint scheme, and congratulated the participating municipalities upon being the first voluntarily to attempt united action in an undertaking of such magnitude so much in advance of pressing necessity.

It is difficult without a map to explain the typographical features of the territory which is being dealt with. Rightly, however, the peninsula is split up into well-defined drainage areas by three main ridges, two running from east to west and the third from north to south. The first ridge runs from Port Moody to Stanley Park, parallel with Burrard Inlet, and from one-quarter to two miles inland. The second ridge parallels the Fraser River from Sapperton to the extreme end of Point Grey, while the third ridge runs south from Hastings Park. These ridges form five natural drainage areas, which the engineer has named by their respective places of discharge—Burrard Inlet, False Creek, English Bay, Fraser River, and Burnaby Lake.

The first area comprises a total of 4,800 acres, and consists of a narrow strip of land draining north into Burrard Inlet and varying from one-quarter to two miles in width from the divide to the water. The False Creek area extends from one-quarter mile back from the creek on the north to three and one-half miles on the south-east. The slope is fairly regular. It comprises 7,400 acres. The English Bay area lies to the south of English Bay and to the west of False Creek. It is the smallest area, consisting of only 5,950 acres. The Fraser River drainage area consists of the whole of the southern portion of the peninsula, and is the largest of all the areas, comprising 17,600 acres. Generally speaking, the contours of this district run parallel to the river and the ridge, though their regularity is somewhat broken by numerous small creeks.

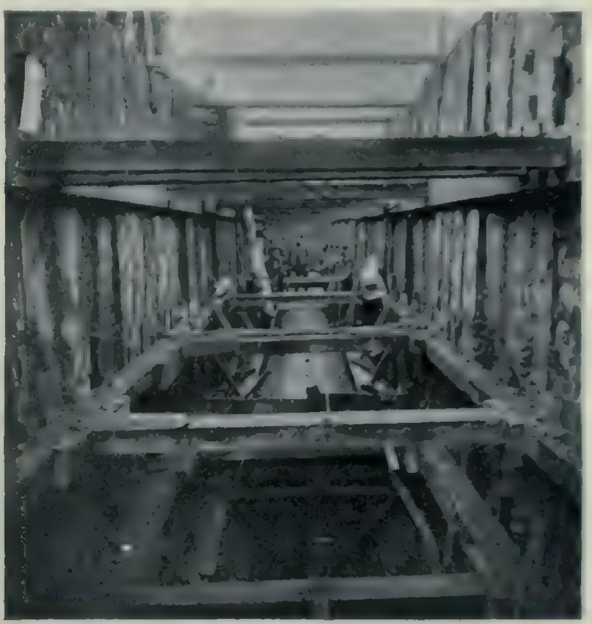
The fifth area is called the Burnaby Lake area, and is next to the Fraser River territory in size, comprising 17,000 acres. From a drainage point of view it presents the greatest difficulties. In shape it resembles a large dish. Its boundaries vary in elevation from 1,200 feet above sea-level at Barnet on the north to 100 feet at Trout Lake, Cedar Cottage. It is mostly uncleared. The westerly portion of the area is drained by a long flat creek known as Still Creek. It discharges into Burnaby Lake, into which most of the westerly portion of this district drains. The outlet from the lake is by the Brunette River, which empties into the Fraser River just above New Westminster.



Pneumatic mixer at work on Horseshoe section, Clark Drive interceptor.

The whole area which it is proposed to drain, and which the system is designed to take care of, reaches the great total of 52,750 acres, or over 82 square miles.

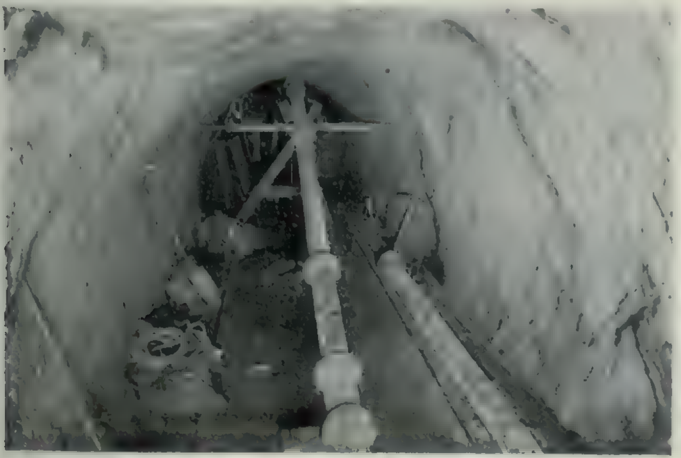
It is pointed out by the engineer that one of the chief problems met with in the laying out of a large sewerage scheme must necessarily be of an economic nature, and the growth of the district to be sewered would be one of the chief factors to be considered. In designing the Greater Vancouver system Engineer Lea estimated that the population of the whole peninsula, including New Westminster, in 1950 would be 1,400,000. In giving his reason for this conclusion, he pointed out that if Greater Vancouver grows at the same rate as Boston the population in that year will be 500,000, while if it grows as fast as Chicago it will be 2,000,000. There is a wide difference in these figures, and he concludes that somewhere between the two lies the true value of the unknown quantity.



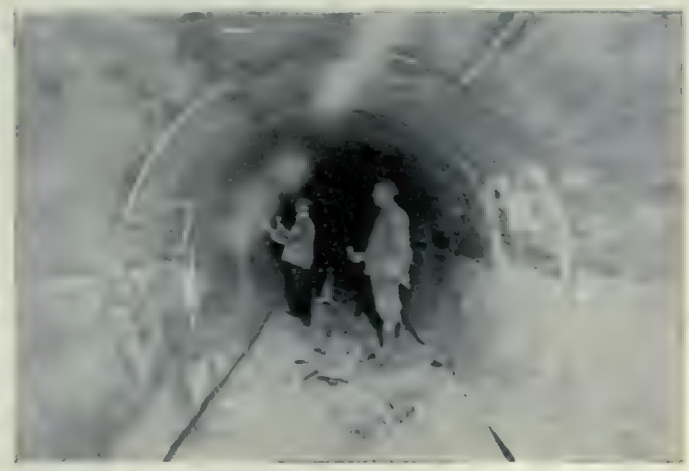
Concrete sewer, Nineteenth Avenue.

The scheme which Engineer Lea submitted is designed to deal with the sewage of a population of 1,217,000 persons within the present municipal boundaries of the four municipalities, together with the rainfall from the area as then developed.

In designing the system it was recognized as absolutely essential that the English Bay foreshore should be preserved from pollution, and to meet this necessity it is proposed to construct an interceptor along the south shore of English Bay from Bridge Street to Imperial Street in Point Grey, with all the necessary outfall works and trunks. The interceptor will



Lining 6 ft. 6 in. Horseshoe section, Clarke Drive interceptor.



Sewer finished with the exception of brick invert. All concrete mixed and placed by compressed air.

be approximately four miles long, and will take care of all the sewerage and drainage in the English Bay district.

The conclusion was also reached that False Creek could not handle the tremendous drainage of Grandview Heights from Nanaimo Street West in addition to all the territory on the slope from Central Park north-westerly to the Creek. It was seen that this flow must be led into the greater waters of Burrard Inlet, and an interceptor along Clark Drive, from Seventh Avenue to the Inlet, will be constructed, together with the necessary outfalls and trunks.

Burnaby Lake is incapable of digesting sewage, and an interceptor which will be nearly eight miles long will be built south of Still Creek and Burnaby Lake, commencing at Ninth Avenue on the easterly boundary of Hastings townsite, and discharging into the Fraser River at Sapperton.

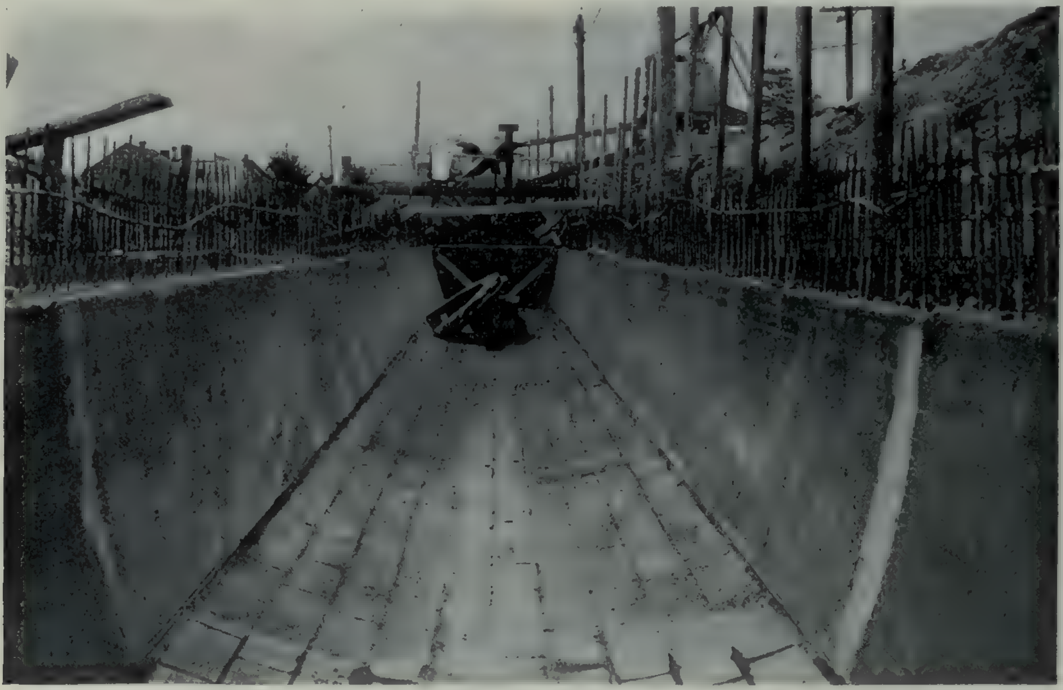
Various trunks will also be built to discharge into the Fraser River to take care of the drainage from the southern slope. The system will also include improvement works on the Brunette River and Still Creek; a West End interceptor and outfall, which will commence at English Bay and discharge into Burrard Inlet just beyond Brockton Point; and a trunk and outfall in Hastings townsite.

Following the reception of the Engineer's report by the Municipal Sewerage Committee and the decision to adopt his recommendations, in the winter of 1913, an Act incorporating the "Burrard Peninsula Joint Sewerage Board" was enacted by the legislature, and in August of that year the Board was organized. It consists of a Chairman, Frank Bowser, a Secretary-Treasurer, George W. Phipps, and a representative from each municipality, as follows: S. J. Crowe, Vancouver; S. G. Churchill, Point Grey; Angus MacDonald, Burnaby; and C. Stuart Campbell, South Vancouver. The engineer in charge is A. D. Creer.

It was not, however, until January, 1914, that the actual work of construction was commenced. The first work done by the Commission was on what is known as the Canoe and China Creek extension. This was really the extension of some sewers which had been built by the city. Connection was made with the old sewer on Glen Drive near Sixteenth Avenue, and construction was carried south on Glen Drive across Kingsway to Nineteenth Avenue, then west on Nineteenth to George Street, and south again to Twenty-eighth—providing an outlet for practically all the territory in South Vancouver between Victoria Drive and Main Street and north of the height of land. This sewer was all circular in form, and ran from 4 feet to 8 feet 6 inches in size. There was over 3,660 feet of tunnelling, nearly all of it from 18 to 20 feet underground. No hard rock was encountered, and the work was completed about the end of 1914. All of the work on this section was done by day work, and cost $230,000—nearly $20,000 less than the engineer's estimate. The amount spent in wages was about $140,000, or 65 per cent. of the total cost.

Section No. 2 was a continuation of the old China Creek sewer. Connection was made at Twelfth Avenue, and construction continued up Woodland Drive to Fourteenth Avenue, thence by an air line tunnel under Buffalo Park and Cedar Cottage, debouching on Lakeview Drive just south of Trout Lake, along that street to Nanaimo, and continuing up the grade in the same general direction as the B. C. E. R. to Central Park. This great trunk possesses three comparatively short branches, extending south, the first of which is on Woodland Drive from Fourteenth Avenue to Twentieth Street. The second is called the Gladstone Creek Trunk, and extends south 1,600 feet to Twenty-ninth Avenue. The third is the Earls Road extension, which runs south on Earls Street to Thirty-ninth Avenue. All of this work, with the exception of the tunnel under Buffalo Park, was open cutting, and the excavation was done with steam shovel.

A trip through the Cedar Cottage tunnel, from Fourteenth Avenue to the foot of Lakeview—a distance of about 1,400 feet, and in some places 80 feet below the surface—was an interesting and novel experience for the writer, and a revelation of the magnitude of the work. The tunnel at this point is 6 feet



Clarke Drive interceptor, Horseshoe section.

6 inches in diameter, and is constructed in what is called the horseshoe design.

Practically all of this section of sewer is constructed of reinforced concrete, and was mixed and placed in the forms by compressed air. In some of the outlying sections, where the pipe runs under 42 inches in diameter, reinforced concrete piping was largely used. The only serious difficulty encountered was in the Trout Lake district, where soft ground was encountered and piling had to be resorted to. The work will be completed this month, having occupied practically the whole of one year. About 250 men were employed throughout. It was all done under contract, Messrs. Hodgson, King & McPhalen being the successful tenderers. The contract figure was $309,000, which was $40,000 under the next lowest tender.

The third section was the Balaclava and Broadway extension. This is an extension of a section of sewer built by the city from English Bay up Balaclava Street to Ninth Avenue (since purchased by the Board). The extension consists of two branches—one east from Balaclava on Broadway to Vine Street, and the other on Balaclava Street to Sixteenth Avenue. This latter section will later on be extended in a south-easterly direction to a point just north of the divide near Strathcona. Two thousand feet of tunnelling was done on this job. Day work was employed throughout, 100 men being occupied for about nine months. The cost was approximately $156,000, of which $82,000 was spent on labor.

Section 4 involved the lowering of the bed of the Brunette River and the construction of a dam at the foot of Burnaby Lake, by means of which complete control of the level of the lake will be secured, and the annual flooding of the adjacent country in the wet season prevented. This work is now nearly complete, and will cost $40,000, of which $28,000 has been spent in wages. This work has been carried on more or less intermittently over eighteen months, and the gangs employed numbered from six to forty men.

Section 5, in Hastings townsite, has not been started yet.

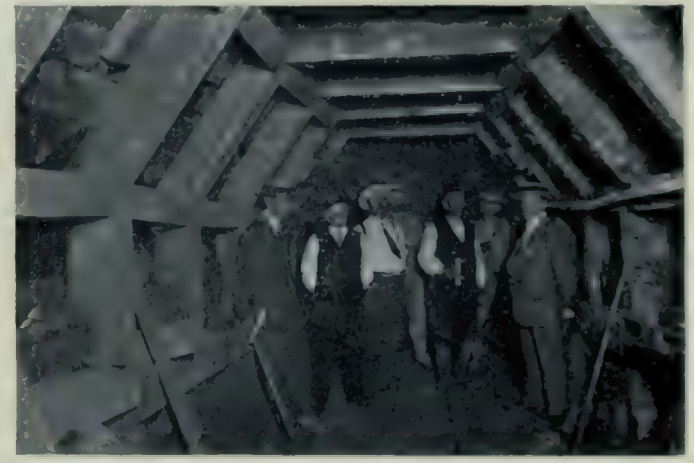
Section 6 is the great Clark Drive interceptor, which begins at Seventh Avenue on Keith Drive and angles across to Clark Drive under the Great Northern cut, and continues north on that street to the Inlet. The whole of this sewer will be an eight-foot horseshoe section, will be 7,500 feet long, about one mile tunnelling, and the balance open cut. It will be done by day work, and it is estimated to cost $256,000. The assistant engineer is Mr. R. E. Wilson.

Section 6 comprises a six-foot tunnel extension to the Clark Drive interceptor, which is being driven about fifty feet below the surface, from high-water mark 1,600 feet out into Burarrd Inlet. This work has just been started, and is being done by H. P. Peterson. An interesting feature of this work will be the manner in which a break will be made from the tunnel into the waters of the Inlet. The sewer will be extended until the danger point is reached, when a number of borings will be made forward. Into these borings heavy charges of dynamite will be inserted. Wires will be attached to the charges and conveyed back through the tunnel to the shore. When all is in readiness an electric current will be turned on and the wall between the tunnel and the ocean will be blown out. The debris will then be cleared away by dredging, and the great Clark Drive outfall will be completed. This should be accomplished in about three months. .

Other work which is projected is the Hastings Park trunk, which will drain an area of about 2,100 acres in that vicinity; the West End interceptor, which will drain practically all the ground west of Homer Street to the park; and the Bridge Street extension, which will connect with the present city trunk at Sixteenth Avenue on Oak Street, and will be carried south to Twenty-seventh Avenue. This last is designed to take care of all the territory between Granville and Main Streets north of the height of land to Sixteenth Avenue. All of the work outlined above, including that already done, will cost about $2,500,000, and will carry the Commission through to the end of 1916.

And now, how is this immense undertaking being financed? And how is the cost being apportioned between the municipalities concerned? As to the financing, the Commission is empowered to issue bonds as required. These bonds are guaranteed by the Government of British Columbia. Up to the present $2,500,000 worth have been sold, which, as stated, will finance the scheme until the end of 1916.

The proper apportioning of the cost was a most difficult problem to solve, and occupied the attention of the Commission and the engineer for months and months after the initiation of the project. In fact, a settlement was not finally reached until the beginning of this year.


6 ft. 6 in. tunnel sewer, Twenty-First Avenue.

The principle followed in the final adjustment was that a part of the cost of any such work must be for the general benefit of the community, and it was ultimately decided to charge one-third of the cost of the system to the whole sewerage area. The other two-thirds was to be charged to the districts immediately benefited, and the apportionment was to be made in each case on the assessed value of the property in each district. The revised apportionment charged Vancouver with 48 per cent., South Vancouver with 30 per cent., Point Grey with 14 per cent., and Burnaby with 8 per cent.

There appears to be nothing that will withstand the tremendous heat of the oxy-acetylene cutting torch. It has melted lime, concrete, and other metals and minerals, heretofore considered absolutely fireproof. The latest is the melting of carborundum, the well-known grinding material, which stands 9.6 in the Mohr scale of hardness, and is only exceeded by the diamond, setting the standard at 10.0. Not only so, but the variety of uses to which the oxy-acetylene torch is being applied is increasing in every conceivable direction, and its popularity bids fair to be of an enduring kind.

Tar, Pitch and Bitumen in Road Construction*

By A. Dryland, M.Inst.C.E.

ONE of the present-day possibilities which fall upon the road engineer, whether in a large or small district, is the decision as to what treatment, under the particular circumstances of each separate road, it is wise and economical to adopt, bearing in mind, firstly, the most important consideration—viz., how to satisfactorily carry the traffic—and, secondly, how this can be done in the most economical way, both in first cost and subsequent maintenance.

The author would like to emphasize the point that it is the particular circumstances of the road which have to be considered, including the kind and quantity of traffic, the subsoil and drainage, exposure to weather conditions, and the thickness and nature of its crust. There is no one road for all conditions, and the road engineer will best fulfil his functions who is able to select and carry out the best form of treatment for the particular conditions he has to meet.

It is more with a view of eliciting a discussion which will help in the formation of a proper judgment on these matters that the author ventures to put forward some views on the use and situations for the three materials forming the subject of this paper than with any desire to suggest any authoritative dicta.

Coal Tar

This most useful material, the author thinks, has been to a great extent the salvation of our roads during the past few years, and still has a great part to play. In the surface treatment of roads it has largely eliminated the dust trouble, and has further largely increased the durability of water-bound macadam, while in the production of tar-macadam it has been a necessary ingredient in the manufacture of a material that has produced excellent road surfaces for all but the very heaviest traffic. A point which is well worth discussion by the institution is the kind of tar which should be used in particular circumstances, and for the purposes of eliciting such discussion the author unhesitatingly puts forward the view that for surface treatment of water-bound roads a good quality water-freed crude tar serves every necessary purpose, and in its penetrative power is superior to distilled tars. It should be said, however, that its use should be avoided where from any cause—such as the vicinity of fishing streams, ponds or watercourses readily reached by tar washings—it may involve risk. Whether a distilled tar or a water-freed tar only should be used in the production of tar-macadam depends, in the author's opinion, as to whether it is to be immediately used or stored.

Coal-tar Pitch

During the last few years a good deal of this material has been used fluxed with heavy oils of tar for the purpose of grouting macadam. The author has executed a good deal of this work, and has seen large areas of it in other countries, and has formed the opinion that it is an unsuitable material for surface work, chiefly owing to its susceptibility to heat, which permits of such movement of the material in hot weather as to destroy the evenness of surface which is so desirable in a road, and, moreover, impairs its waterproofness to such a material extent that winter conditions act most unfavourably upon it. Its softness in summer is in great contrast to its extreme hardness in winter (where it remains waterproof), and the author has had more complaints of slipperiness than on any other kind of surface he has laid. The author further puts forward the view—again with the hope of eliciting discussion—that the method of pitch-grouting as now practised is a crude and unsuitable way of using the material, inasmuch as far too great a quantity of the matrix is so used. The author contends that if pitch and oil are to be successfully used as binding ingredients they should be used with properly dried and heated stone in a suitable mixer, where the quantity of matrix can be properly regulated, and the minimum quantity used to coat the stone. It will be found by this method the matrix used can be reduced by nearly 50 per cent. In the author's view it is largely the great quantity of matrix used in the grouting method, without any certainty of the regular and proper coating of the stone, which has led to the unsatisfactory results on heavily trafficked roads which the author has found in so many cases, and not least in his own experience. In the author's opinion a well-regulated pitch and oil mixture properly applied to thoroughly dry heated stone forms a very strong macadam, but he would prefer to use it as a strength coat or base for material less susceptible to sun heat.

The author knows of cases in towns—where the traffic is necessarily slow, and where there is less exposure to the sun, and facilities exist, such as prompt "chipping" or watering, for mitigating the effects of heat—where considerable success has been achieved by the grouting method; but here again one comes to particular circumstances. While, therefore, the author would assert that it is not a satisfactory method for exposed country roads subjected to heavy and fast traffic, he is not prepared to say that its use should be abandoned where the local conditions permit of success; but even in these cases the author would suggest that the excess of matrix which is almost inherent in the system of grouting is a disadvantage.

Bitumen

The author does not propose to tread the thorny path of discussing what is or what is not bitumen, but will in this paper be understood to refer to either natural bitumens derived from deposits or bituminous residuals from the distillation of mineral oils. All the author would desire to say as a word of advice to those who are making their first venture is to be careful in their selection of the material they use, and, if possible, to obtain not only inspections under different weather conditions of the material as laid, but reliable information as to the time at which it was laid, the subsequent repairs, the nature of the base, and the traffic to which it is subjected.

Another point the author would like to emphasize is the absolute necessity of a sound base. No success can be possible unless the substratum is absolutely sound.

With regard to the use of bitumen, its first cost and expense of manufacture is, in the author's opinion, too great to permit of its use except as a wearing surface, and, provided it is laid on a thoroughly firm base with a satisfactory key, the author puts forward the view that, while an inch is probably nearly the minimum thickness at which it can be laid to give an extended life, no great advantage will be gained by any considerable increase beyond that thickness.

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* Paper presented at the annual meeting of the Institution of Municipal and County Engineers.

A most important point for consideration in the use of bitumen is the aggregate with which it is to be incorporated which will govern to a great extent the proportion of the matrix. The bulk of the aggregate will generally consist of a silica sand, and it is important that it shall be of perfectly clean crystals not too rounded in shape, with a satisfactory grading. A fine filler is also a necessary ingredient, and this is one of the points in connection with the manufacture of bituminous surfaces in which there is some variety of opinion. What may be termed the standard filler is Portland cement, but as this is expensive, and, as far as can be judged, its hydraulic properties can be of no useful service, the author sees no reason why some cheaper material of approximately equal specific gravity and fineness should not be substituted. Another point as to which there is a difference in opinion and practice is the use of a proportion of coarse-grade particles, such as granite chippings, in bituminous carpets, and the proportion which may be incorporated in the bulk. The author has sections of road containing from 10 per cent. to as much as 60 per cent. of granite chippings, but is inclined to the view—on which he will be able to give a more reliable opinion at a later date—that a much less proportion—probably from 12 to 15 per cent.—is quite as much as it is desirable to use. It is quite probable that better results will be obtained without any admixture of chippings. The author is experimenting in these directions, and when sufficient time has elapsed hopes to be in a position to furnish the institution with the results of his observations.

Assuming a suitable aggregate and bitumen has been found, the manufacture and laying of the material need the utmost care to get the best results. The aggregate must not only be raised to the requisite temperature, but care must be taken to see that it has been thoroughly dried, as it is possible to have sufficient heat without extracting the moisture. Efficient drying and mixing plant is therefore essential, also the utmost care in every detail of the admixture of the ingredients, with frequent tests of the material to see that no substantial variation takes place from the standard set up.

Having referred to some of the questions upon which the practice in manufacture of bituminous work in this country may be said to be somewhat in a state of flux, and with the main considerations in the production of a suitable material, the author will endeavour to suggest the conditions in which he thinks this material may be most serviceable under existing conditions, and with our present state of knowledge. The author places this material between the most durable tar-macadams and wood or granite-sett pavings, and therefore advocates its use where the traffic conditions are too severe for the former, but do not justify the large capital outlay for either of the two latter pavings. The author has for long been tempted to suggest some standard of traffic as a dividing line between these various forms of surfacing, but the varying effect arising from the different kinds, weights and speeds of vehicles, together with the physical features of the road, would, he fears, make such a standard misleading, and he has come to the conclusion that it is a subject for individual judgment in each case after observation of all the conditions prevailing.

On the debatable question of "carpet" or "two-coat" work further experience is necessary before attempting to rule out the former method, although the author's predilection is in favour of the latter as offering a more sure basis for satisfactory results. The author has had the most excellent results from bituminous carpets, 1 in. only in thickness, on a water-bound macadam base, where such base has been absolutely sound, but where this latter condition has not prevailed the repairs have been very considerable. In embarking on a scheme last year for the resurfacing of some 25 miles of road with bituminous wearing surface the author decided to adopt the "two-coat" method and is forming the base coat, 2½ in. in consolidated thickness, of scarified material with a pitch and oil matrix, and laying thereon a 1¼-in. bitumen surfacing, all being laterally supported by a 9-in. by 4-in. reinforced in situ concrete submerged kerb.

Portable Mixer Uses Old Asphalt for Pavement Patches

In relaying asphalt pavements adjacent to street-car tracks the traction company in Milwaukee is using a ¾-yd. hot mixer, fed with the material cut out in making patches and repairs. The company has a large stationary plant but has found greater economy in utilizing the portable outfit on three jobs aggregating 3 miles recently completed. The mixer used, which is a Koehring, is run, including the charging, hot blast and propelling apparatus, by a 15-h.p. motor run at 550 r.p.m., fed from the trolley. For long moves from one part of town to another the outfit is drawn by a utility car or horses.

Fifteen men in a working day have taken up and relaid 180 sq. yd. of asphalt pavement from 2 to 3 in. thick located between the rails. The entire operating cost on the plant, including team charges, but not depreciation or interest on the special investment, has been about 42 cents per square yard for patch work. This includes tearing out and repaving with old material and such small amount of new material as is required.

The procedure is to repair one track at a time and maintain uninterrupted car operation over both tracks without blocking vehicular traffic except on one side of the street.

The gang consists of the following men: One foreman, one man breaking up asphalt, one man feeding the mixer, five men preparing concrete and sub-base and wheeling remixed asphalt, one man painting paving stones with hot asphalt and applying the cement to the surface of the finished pavement, one man running the mixer, one man wheeling hot asphalt, three men raking, smoothing and tamping, one night watchman and one teamster. In addition to ripping up the old asphalt and relaying the pavement, this gang also keeps the street in safe operating condition. A two-horse team also is a part of this outfit.

The procedure of the work from front to rear is as follows: On the jobs recently completed a part of the work consisted in relaying the asphalt between the granite gage blocks on a busy double-track line. The old asphalt surface is first picked up and thrown over to the side of the street. Then the larger pieces are broken into pieces about 6 in. square, the smaller sizes being more readily melted. The mixer is charged with approximately 8 cu. ft. of this old material, and new asphalt in varying amounts, usually about 10 lb. per charge, is added in accordance with the character of the old mix.

About 9 min. are required for melting and mixing a charge. During the first 6 min. the maximum hot blast is applied, and the temperature is then reduced for the last 3 min. The blast is furnished by a blower driven by the main motor. This blower operates in connection with two crude-oil burners, the flame from which is distributed in such a way that only the hot-air blast, and no flame, strikes the mix. This prevents burning. The oil consumption is about 50 gal. per day. Crude oil is purchased in tank cars and delivered to the job in a steel tank which holds 310 gals.

After a mix has been heated it is discharged into two-wheel concrete cars and immediately dumped in the track. Then it is raked, tamped and smoothed in the usual manner. Afterward a surface is given it by rolling with a hand roller loaded with water.

Representatives of the Milwaukee Electric Railway & Light Company, who are handling the work with day labor, state that the quality and speed of work performed with this hot-mixing outfit will improve with experience in its operation, but they are now satisfied that the unit costs, particularly for pick-up and patch work, are considerably lower than those which usually obtain for similar work executed under the old methods or under contract.—Engineering Record.

Temperature Changes in Mass Concrete*

By C. H. Paul and A. B. Mayhew

THE Arrowrock Dam, being constructed by the United States Reclamation Service near Boise, Idaho, and on which the writers are employed as construction engineer and principal engineering assistant respectively, is of the gravity type, and is curved in plan to a radius of about 662 ft. at the centre of the crest. Inasmuch as little information is available concerning temperature changes in large bodies of masonry, and as this is often an important factor in the design of high dams, it was decided, for the benefit of future designs and to further engineering knowledge in general, to install in the Arrowrock Dam devices for recording the temperature of the masonry at various distances from the exposed faces. Nine of these devices have been installed to date, and have been in place for periods ranging from about three to about nineteen months.

It will probably be several years before a complete study can be made of the temperature changes, but, as the data on this subject is so meagre, it is deemed advisable at this time to place before the Society the results thus far obtained, together with a description of the apparatus used and the principal conditions affecting the temperature readings.

The electrical resistance thermometer was considered to be the simplest and best apparatus for the purpose contemplated. The fundamental principle of the resistance thermometer is the fact that a change in the temperature of a metal causes a corresponding change in its electrical resistance.

The thermometer, or resistance bulb, consists of a coil of fine copper wire, encased in a metal tube about ⅜ in. in diameter and about 5 ins. long. One end of the tube is closed and the other end is soldered, with a waterproof joint, to a lead-covered cable containing the wires connecting the bulb with the switchboard to which the temperature indicator is attached.

The leads connecting the thermometer to the switchboard are constructed as follows: Each wire of the cable is insulated with three wrappings of silk, thoroughly saturated with beeswax after wrapping. The three strands of which the cable is formed are then brought together and encased in one wrapping of cotton and one of braid similarly waterproofed. The cable is then drawn into the lead armour, the latter being soldered directly to the brass tube containing the resistance cells.

The temperature indicator consists of a modified Wheatstone bridge calibrated to read temperature units instead of ohms. The dial is direct-reading in degrees, Fahrenheit, with a range from zero to 100 deg., and, by interpolation, can be read to about 0.1 deg. It is claimed by the manufacturers that accurate results may be obtained with the indicator to 0.25 deg., and with the apparatus as a whole to 0.5 deg. From comparative readings made with an ordinary mercury thermometer, it appears that these claims are fully ustified.

The resistance bulbs were placed in one vertical plane, but at various elevations and at different distances from the exposed faces of the dam. Ultimately there will be one resistance bulb near the top of the dam, one about halfway between the original river level and the bedrock foundation, and eight more at intermediate elevations. When each resistance bulb was placed in the masonry, the lead-covered cable was encased in ½-in. steel tubing and carried to an inspection gallery in the body of the dam, where the switchboard and indicator were installed. When the concrete in the dam was built to the approximate elevation at which it was desired to place a resistance bulb, concreting in that immediate vicinity was usually discontinued temporarily, and the concrete was allowed to set for a few hours. The bulb and conduit were then embedded in a trench, about 6 ins. deep, excavated in the concrete, great care being taken to provide a soft, uniform bed for the bulb, and to cover it carefully. Deviation from this practice is mentioned, and further details are given in the following paragraphs.

The greater part of the masonry in the body of the dam is composed of sand-cement, river sand, river gravel, and river cobbles, mixed in the proportion of about 1:2½:5:2¾, although these proportions have been varied from time to time. Unless otherwise specified, it is to be understood that the cement used in all concrete is sand-cement. In all cases the sand-cement is the product of grinding, in a tube mill, Portland cement and pulverized granite, mixed in the proportions of 45 per cent. of granite and 55 per cent. of Portland cement by weight. The faces of the dam are composed of a richer concrete than that used in the body; the thickness of the face mig varying with the elevation above bedrock. In most cases the cement used in the face mix is composed of about 76 per cent. of sand-cement and about 24 per cent. of straight Portland cement by volume, and the concrete mix is about 1:2:4:2½.

In some cases concreting was not carried on continuously directly above the thermometers.

The up-stream face of the dam is an east exposure, and the down-stream face is therefore a west exposure.

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* Abstract of paper read before The American Society of Civil Engineers.

Because of the great depth of the dam foundation below the river bed—about 90 ft.—and the correspondingly great danger from floods, it was decided to uncover at first only a portion of the bed-rock along the line of the up-stream face of the dam and to build thereon a wall of concrete having a cross-section heavy enough to form a gravity section at the height to which it was built. After this wall had been brought up to about 40 ft. above the old river bed, the remainder of the bedrock foundation was uncovered, and concrete was placed to form the full section of the dam. The wall constructed first is known as the "first section of the dam." The concrete in this wall was placed intermittently between November 10th, 1912, and April 15th, 1913. The remainder of the masonry in the dam, to elevation 3 014.5, is known as the "second section of the dam," and was placed between July 10th and December 1st, 1913. At the end of the 1914 season the top of the masonry will be at about elevation 3,160, and the concrete placed above the second section and below elevation 3,160 is known as the "third section of the dam." The masonry in the third section was placed between February 26th and about December 1st, 1914.

No water had been stored in the reservoir up to the time of this writing.

Thermometer No. 1.—At about 12.00 m. on August 20th, 1913, resistance thermometer No. 1 was placed in a trench, about 6 ins. deep, excavated in a 1:2½:6:2 mixture of concrete placed about 3.00 p.m. on August 19th. This concrete was originally of the plastic consistency ordinarily used, but, at the time the thermometer was placed, a shallow pool of water had accumulated at the point where it was desired to embed the bulb, and the trench therefore filled with water as fast as it was excavated. At this time the concrete was shaded from the direct rays of the sun by the first section of the dam, and by a lava bluff to the south. While the bulb was lying in the trench and covered with water, the indicator registered a temperature of 66.5 deg. Fahr. At about 1.30 p.m. about 8 cu. yds. of fresh concrete were deposited over and around the bulb to protect it. At this time the sun was shining brightly on the concrete in the vicinity of the bulb, and continued thus until 6.15 p.m. A uniform layer of concrete about 2.5 ft. was placed in the immediate vicinity of the bulb between 7 and 8 p.m. on August 20th.

The highest temperature recorded by thermometer No. 1 was 94.0 deg. Fahr., which reading remained constant from September 20th to 25th, inclusive, at which time there was a mass of 15.5 ft. of concrete directly above the thermometer. Assuming the initial temperature of the concrete as 66.5 deg., the maximum rise in temperature, due primarily to chemical action, was therefore 27.5 deg., and occurred during a period of thirty-one days.

Thermometer No. 1 is 76 ft. from the down-stream face of the dam, about 60 ft. above bedrock, and about 43 ft. from one of the sluicing outlets. The temperature in this outlet was above freezing throughout the winter of 1913-14.

Thermometers Nos. 2 and 3.—At about 3 p.m. on October 19th, 1913, thermometers Nos. 2 and 3 were placed in a trench, about 6 ins. deep, excavated in concrete placed about 1 a.m. on the same day. Thermometer No. 2 was placed in a 1:2:4¾:1½ mixture of concrete, of plastic consistency. The cement consisted of approximately 78 per cent. of sand-cement and 22 per cent. of straight Portland cement. Thermometer No. 3 was placed in a 1:2½:6:2 mixture of concrete, although it is probable that this concrete may have contained a small quantity of the face mixture in which No. 2 was embedded. In water content, this concrete, near the surface, at least, was above normal.

Although the greater part of the masonry in the dam was exposed to the direct rays of the sun on October 19th, the portion in which the thermometers were placed was, at that time and during all the winter, in the shadow of the mountains to the south of the dam.

At 3 p.m. on October 19th, while the resistance bulbs were lying in the trenches, but before being covered with concrete, registration of No. 2 was 57 deg., and that of No. 3 was 52.8 deg. The bulbs were then covered with concrete to a depth of about 6 ins., to protect them from injury. At about 9 a.m. on October 20th about 2 ft. of the regular 1:2½:6:2 mixture of concrete was placed over bulb No. 3, and at about 10 a.m. No. 3 registered 49.5 deg. and No. 2 2.55 deg. Between 10 p.m. on October 20th and 2 a.m. on October 21st about 4 ft. of the face mix concrete described above was placed over bulb No. 2, and the regular mixture of concrete was brought up to a total height of about 4 ft. above bulb No. 3.

About October 25th the temperature readings on thermometer No. 2 began to show irregularities, and it soon became apparent that there was a partial short circuit. Readings could be taken with a weak battery current, but were undoubtedly not entirely accurate. It seems probable that moisture penetrated the joint between the bulb and the lead cable. It was thought that the continual application of current while the insulation was in a moist condition might permanently injure the insulation; and, as the extent of the inaccuracy in the readings could not be determined, it was decided to discontinue the readings temporarily in the hope that the moisture would ultimately be absorbed by the concrete and the apparatus return to its normal condition. Although some improvement has been shown in the trial readings made from time to time, the results obtained from this thermometer are still unreliable.

The highest temperature recorded by thermometer No. 2 was 74.5 deg. on October 25th. Assuming the initial temperature of the concrete as 55 deg., the maximum rise in temperature was therefore 19.5 deg., and occurred in a period of five days. As this thermometer is only 3 ft. from an exposed face, it is probable that the air temperature, which was low at this time, counteracted more or less the heat generated by chemical action.

The highest temperature recorded by thermometer No. 3 was 86.2 deg., which reading remained constant from December 4th to 22nd, inclusive. Assuming the initial temperature of the concrete as 49.5 deg., the maximum rise in temperature, due principally to chemical action, was therefore 36.7 deg., and is the greatest rise recorded by any of the thermometers under consideration. This rise occurred during a period of forty-five days. At this time there was a depth of 28.5 ft. of concrete directly over the thermometer.

Thermometers Nos. 2 and 3 are 3 ft. and 20 ft. respectively from the down-stream face of the dam.

Thermometer No. 4.—About 5 p.m. on March 20th, 1913, thermometer No. 4, the first one installed in the dam, was embedded about 18 ins. in a 2.5-ft. layer of concrete placed during the previous hour or so. After the bulb was placed, concreting in this vicinity was continued until the surface was brought to about 3.5 ft. above the bulb, at which elevation the surface of the concrete, directly above the bulb, remained for the following seven months. A key in the surface of the concrete in the first section of the dam was constructed directly over thermometer No. 4. The concrete forming the sides of this key was brought up to a height of about 7 ft. above No. 4 on March 22nd, and concreting in that vicinity was then discontinued for several months.

The initial temperature of the concrete in which thermometer No. 4 was placed was not recorded, but the initial temperature was probably about 44 deg. The highest temperature recorded during the period when chemical action appeared to be the controlling temperature factor was on April 4th, when the temperature reached 64.6 deg. This rise occurred during a period of fifteen days.

Concreting immediately above thermometer No. 4 was resumed on October 20th, 1913, at which time the thermometer had been in place for seven months, and a decided rise in temperature began to appear six days later.

Thermometer No. 4 is 19.5 ft. from the inspection gallery and 58.5 ft. from the up-stream face of the dam. During the period from March 21st to October 20th, 1913, the thermometer was 3.5 ft. below the surface of the concrete, and during the period from November 15th, 1913, to April, 1914, it was 34.5 ft. below the surface. During the winter of 1913-14 the temperature in the inspection gallery was slightly warmer than that of the air outside, but was below freezing during a considerable portion of the time.

Thermometer No. 5.—At 9.30 a.m. on October 29th, 1913, thermometer No. 5 was placed in a trench, about 6 ins. deep, excavated in concrete placed during the evening of October 28th. This concrete was of plastic consistency, and was mixed in the proportions of 1:2¾:4:1½. The cement consisted of approximately 78 per cent. of sand-cement and 22 per cent. of straight Portland cement. Considerable reinforcing steel for the trash-track structure was also embedded in this concrete, and extended out to within 3 ins. of the up-stream face of the dam. After covering the bulb with concrete to a depth of 6 ins., the temperature recorded was 43 deg. About 1 ft. of the face mix of concrete described above was placed over the thermometer during the evening of October 30th.

The highest temperature recorded was 69.8 deg., which was reached on November 3rd. The maximum rise in temperature, due primarily to chemical action, was therefore 26.9 deg., and occurred during a period of five days.

Thermometer No. 5 is 3.5 ft. from the up-stream face of the dam, and 3 ft. above the concrete in the first section of the dam. It is probable that the temperature of the air, which was low, had an effect on this thermometer similar to that mentioned in the case of thermometer No. 2.

Thermometer No. 6.—At 12.00 m. on June 23rd, 1914, thermometer No. 6 was set in the usual manner, in concrete placed about 2 a.m. on the same day. Between 1 and 2.30 p.m. on the 25th the surface of the concrete was brought up to a point about 3 ft. above the thermometer. About this time it was discovered that there was an open circuit in the apparatus. A hole, about 6 ft. in diameter at the top, 2 ft. in diameter at the bottom, and 3.5 ft. deep, was excavated in the concrete, and the thermometer was removed. The trouble was located in the resistance coil inside of the metal tube, and was remedied.

At 9 a.m. on June 26th, a bed of concrete, about 6 ins. deep, was deposited in the bottom of the hole excavated in the concrete on the previous afternoon, and on this bed thermometer No. 6 was placed. At 9.30 a.m., after the bulb had been covered to a depth of 6 ins., the temperature recorded was 61.5 deg. Between 11 p.m. on June 26th and 2.30 a.m. on June 27th the remainder of the hole was filled, and the general elevation of the surface of the concrete was brought up to a point 3.5 ft. above the thermometer. The concrete was mixed in the proportions 1:2½:5½:2¾.

The highest temperature recorded by No. 6 was 96.2 deg., and occurred on October 5th. This was the highest temperature recorded by any of the thermometers under consideration. The maximum rise in temperature, due primarily to chemical action, was therefore 35.7 deg., and this rise occurred during a period of 101 days. (A rise of 32.2 deg. was recorded during a period of thirty-one days).

Thermometer No. 6 is 31 ft. from the up-stream face of the dam, and on October 1st was about 80 ft. below the surface of the concrete.

Thermometers Nos. 7, 8, and 9.—On August 20th, 1914, thermometers Nos. 7, 8, and 9 were placed in a trench, about 2½ ft. deep and 3 ft. wide, formed in concrete placed on August 8th and 9th. At 1.30 p.m., while the bulbs were in place in the trench, but not covered with concrete, the readings of thermometers Nos. 7, 8 and 9 were 77 deg., 77 deg., and 73.5 deg. respectively. A bed of fresh concrete, about 6 ins. in depth, was then placed in the bottom of the trench and under the thermometers. Then concrete was deposited over them to a depth of 1.5 ft. in the case of Nos. 7 and 8, and 2 ft. in the case of No. 9. At 3.20 p.m., when this had been accomplished, the readings of the thermometers was 74 deg., 75 deg., and 75.5 deg. despectively. No. more concrete was placed over these thermometers until September 4th. On September 9th the surface of the concrete had been brought up to a point about 13 ft. above the thermometers, and on October 1st to a point about 36 ft. above them. The concrete in which Nos. 7 and 9 were embedded was mixed in the proportions 1:2:4:2½, and the cement used consisted of approximately 76 per cent. of sand-cement and 24 per cent. of straight Portland cement. The concrete in which No. 8 was embedded was mixed in the proportions of 1:2½:5:2, although it is probable that this concrete contained more or less of the face mixture.

The highest temperature recorded by thermometer No. 7 was 77.6 deg., and occurred on August 21st, about twenty-four hours after it was placed. Another slight rise in temperature is shown about September 8th, or shortly after the concreting above No. 7 was resumed.

The highest temperature recorded by thermometer No. 9 was 78 deg., and occurred on August 21st, and again on August 22nd, although there was an intermediate reading of 77.8 deg. This thermometer also shows a slight rise about September 8th.

The unusually small rise in temperature, due primarily to chemical action, recorded by thermometers

Nos. 7 and 9, was undoubtedly caused by the following conditions:—

(1) These thermometers are only 2 ft. and 15 ft. respectively from the faces of the dam ,and were covered to a depth of only 1.5 ft. and 2 ft. respectively.

(2) The concrete forming the sides of the trench in which the thermometers were placed was deposited eleven or twelve days previous to the time they were put in position.

(3) After a small quantity of fresh concrete had been deposited in the trench and over the thermometers, no more was placed in this vicinity for a period of eight days.

The highest temperature recorded by thermometer No. 8 was 91.6 deg., and this reading remained constant from September 21st to 24th, inclusive. The maximum rise, due primarily to chemical action, was therefore 16.6 deg., and occurred within a period of thirty-two days. It would probably be more nearly correct to consider the rise due to chemical action as taking place between September 4th and 21st, in which case the rise would be about 21 deg. in seventeen days. On October 1st there was a depth of approximately 35 ft. of concrete directly over this thermometer.

Thermometers Nos. 7 and 8 are 2 and 10 ft. respectively from the down-stream face of the dam, and No. 9 is 1 ft. from its up-stream face.

DISCUSSION OF RESULTS OBTAINED

The effect of the temperature of the air in counteracting the heat generated in the concrete by chemical action is illustrated by the fact that all the comparatively low maximum temperatures recorded by several of the thermometers occurred at points where the distance to an exposed face was comparatively small, and that all the high maximum temperatures recorded by a few of the thermometers occurred at points where the distance to an exposed face was considerable, and over which concrete to a considerable depth was placed during a comparatively short period. Therefore, it appears probable that the speed of placing has fully as much influence on the maximum temperature of mass concrete as either the season of placing or the richness of the concrete.

The duration of the rise in temperature, due primarily to chemical action, is undoubtedly largely dependent on the speed of placing, season of the year, consistency, brand of cement, and quantity of cement per cubic yard of masonry. From incomplete results obtained by placing a mercury thermometer inside the forms of the regulating outlets, it was found that a temperature of 99 deg. was produced in about twenty-four hours by the chemical action, caused by the setting of the 1:2 Portland cement mortar composing the lining of these outlets. It is probable that a higher temperature than that recorded actually existed in the masonry. The consistency of this mortar was somewhat dryer than that ordinarily used in the concrete.

The results obtained from thermometer No. 5 serve as the best illustration of the seasonal variation in the temperature of the concrete. These results cover a period of one year, and show a seasonal variation of 32.2 deg., at a distance of 3½ ft. from an exposed face, the lowest temperature being recorded on February 21st, and the highest on August 17th.

The results obtained from thermometer No. 4 between about April 15th and October 15th, 1913, also illustrate the seasonal variation. As these readings were taken at much more frequent intervals than in the case of thermometer No. 5, they show more conclusively that high or low temperatures of the air for short periods do not materially affect the temperature of the concrete 3 ft. or more from an exposed face, and that it takes some four or five days for the effect of continued high or low air temperatures to appear in the temperature of the concrete at that distance from the face.

The results obtained from thermometer No. 3 indicate that there is very little seasonal variation in the temperature of the concrete 20 ft. or more from an exposed face.

The slight rise in temperature recorded by thermometers Nos. 1, 3 and 4, about August 1st, tend to indicate that there may be a slight seasonal variation in all the masonry in the dam; however, the results obtained to date are insufficient to be conclusive on this point.

For an investigation of this sort, a long time is required before the drawing of many definite conclusions is warranted. Most of the opinions expressed in this paper seem to be warranted by the facts, but it is realized that the effect of chemical action in the concrete, which is still going on, may not be fully understood, and that possibly later developments will show the need of modification of some of these conclusions.

For crossing a bay twenty miles wide connected at each end with a fine driving beach along the seashore, a motorist of Aberdeen, Wash., uses a barge built for less than $100 and so equipped that it can be driven by the car that it transports across the water. A propeller wheel, that is housed for safety, is placed at each side of the barge near the stern. The axle of each wheel is at the right height to come in line with the rear car axle when the end of the car is raised a few inches above the deck of the barge, and is capped with a hardwood wheel, 18 in. in diameter and 2 in. thick. On each wheel are leather clamps for securing it to the spokes of the car wheel. With the rear of the car raised so that the wheels are clear of the deck and these wheels connected with the propellors by the straps, the barge is ready for operation by the engine of the automobile. The work of placing the car aboard the barge and making it ready for use requires about eight minutes.

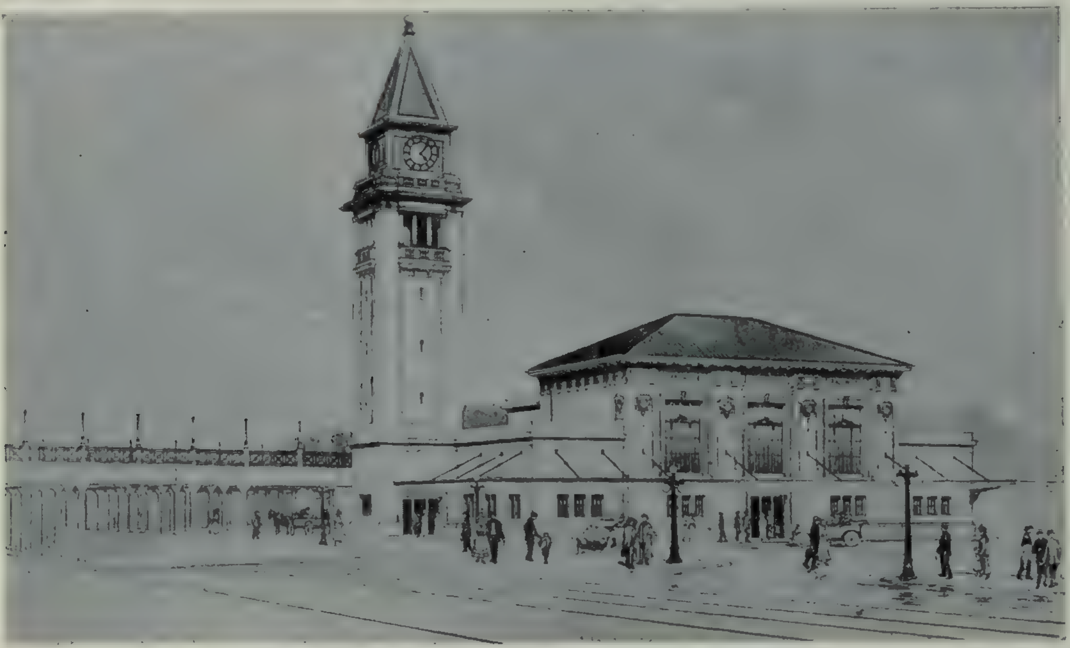
A recent advance bulletin of the U. S. Geological Survey states that the output of "natural asphalt" in 1914 amounted to 77,588 tons. As the term "natural asphalt" is, in the language of the industry, exclusively applied to native bitumens such as Trinidad Lake Asphalt and Bermudez Lake Asphalt, it seems desirable to explain that as used by the Geological Survey natural asphalt includes only gilsonite, elaterite, grahamite, bituminous limestone and bituminous sandstone. In other words, the total of 77,588 tons of "natural asphalt" does not include the production of Trinidad and Bermudez, or any other natural asphalt, as this phrase is understood in the industry.

In excavating for the humus tank in the building of an extension to the sewage disposal works at Wanstead, a suburb of London, there was discovered, twenty feet below the surface, the thigh-bone of a rhinoceros, which it is assumed had roamed through the valley in the days when the world did not trouble itself with contact beds and septic tanks.

Foundation Stone Laid for Splendid New Station at North Toronto

THE design of the new station which the C. P. R. and C. N. R. are building at North Toronto—the foundation stone was laid on September 9th—is a free adaptation of the Italian Renaissance to the requirements of the present day. It will be a single storey building faced externally with cut stone, the stone being Tyndall limestone from the quarries of the Wallace Limestone Company in Manitoba. A spacious waiting room, 70 ft. by 50 ft., of lofty proportions, will occupy the centre portion of the structure, marked on the south elevation of the building by three large semi-circular headed windows. To east and west of the central block will be two subsidiary wings roofed at a lower level and devoted to station facilities—that to the west to men's and women's waiting rooms with their respective lavatories, and that to the west to ticket offices of both companies. To the north of the waiting room will be the concourse, and beyond that again the midway, from which access will be had to the various platforms. Flanking the building, at its northwest corner, will be a clock tower also faced with cut stone. This tower will be 143 ft. high, dominating all other buildings in the neighborhood and having clock dials 8 ft. in diameter. The vestibule under the tower will lead into the concourse along the north side of the west end of the waiting room, connecting at its east end with the midway. The south and west sides of the station will have a sidewalk, so that passengers may alight either at the main entrance centrally on the south side, or to the tower vestibule. Along the west side of the station there will be a 28-ft. driveway, so that vehicles may drive up to either station entrance, and pass through under the tracks through this driveway and out on Yonge Street to the north of the station. The midway will be a passage 20 ft. wide and 150 ft. long, passing from the rear of the station to the far side of the tracks, under the latter. The elevation of the tracks makes a difference in grade of 15 ft. 6 in. between the track platforms and the station level, giving a headway in the midway of about 11 ft.

The waiting room, which is to be 38 ft. high, will be lined with marble to a height of 12 ft., above which the walls will be finished with caen stone plaster. These wall surfaces will be treated in a broad manner with large panels designed to group with the three great windows on the south side of the room. The ceiling will be of plaster, flat in section, but divided by two large beams into three main bays. The concourse, some 15 ft. high, will be lined with Taience tiles to a height of 9 ft., above which the walls and ceiling will be finished in plaster. The treatment of the ceiling will be domical, there being three domes, segmental in section, penetrated by segmental arches, and having a circular skylight in the centre of each. The midway leading out of the concourse will be treated in somewhat similar manner, but as it runs right under the tracks, its height will not be so great. The walls will be lined with Taience tiles to a height of 9 ft., and above that will be finished in plaster, as also will be the ceiling. The ceiling will be divided by segmental arches into square bays, each being treated as a plain groined vault. The floors throughout will be of marble tile.



Proposed new station at North Toronto, estimated to cost $250,000.

The building was designed by Messrs. Darling & Pearson, of Toronto, and the work is being carried out under the supervision of Mr. D. H. Mapes, Engineer of Buildings for the Canadian Pacific Railway.

It is a far too common practice to leave mixers and other mechanical equipment exposed to the weather when idle. A good tarpaulin cover costs less than 1 per cent. of the cost of a new piece of equipment and is low insurance.

Testing Buildings for Settlement

DURING the progress of subway construction in cities, it not infrequently happens that there is movement of the nature of settlement or subsidence induced in buildings along the route, as the result of the undermining of supports. In order to ascertain from time to time if such movement exists, permanent benchmarks are established on the structures.

A good practice, as pointed out by P. M. Entenmann, of the New York Public Service Commission, in The Public Service Record, is to set all the marks at some even-numbered elevation, so that, when checking the elevation of the points, it is unnecessary to have the original record in the field, as any other than an even-numbered elevation indicates movement. A record of the elevation is kept on 8 by 11-in. sheets which give the plan of the building, a description of the benchmark, etc. Whenever levels are taken on a building, a record is made on the sheet, and the differences are noted. There is a general sheet for each building. A sheet of similar form is used for elevated-railway columns.

In addition to fixing the elevation of some permanent mark on buildings and elevated-railway columns, these structures are plumbed so that the movements due to construction can be detected. An auxiliary base-line is run close to the buildings, and sights are taken with a transit to points on the top and bottom of the structure. In the case of buildings, marks are cut on the wall as near the roof and as near the sidewalk as possible, and sometimes at intermediate points, and a record made of the reading from these points to the auxiliary base-line. Movement of the building as a whole, as well as any change in inclination, can then be detected.

In the case of elevated-railway columns, marks are cut at top and bottom, and readings are taken to the auxiliary base-line, and also to a line at right angles to this line at each column, so that movement in any direction can be observed.

Prior to beginning construction work, an examination is made of each building which might be affected by the work. A report is made of the condition of each room of the building, describing all the defects in the walls, ceilings, and all ordinary conditions which might later be attributed to subway work; and in addition a similar record is made of the condition of the exterior, the cellar, and the roof.

Post-Mortem Praise

THE "slings and arrows" are directed so fast and furious at the municipal engineer during the time of his ministration upon this mundane sphere that it is refreshing to find him honoured, even in death. But it seems hard that a man should have to endure all the bitter things of life and pass out having a tithe of honour only after it is too late for him to know anything about it.

In our esteemed contemporary, The Surveyor, of London, England, we read of one George Allan Barfoot, Principal Assistant in the office of the Borough Engineer of Islington. Mr. Barfoot, who had been promoted to the rank of Lieutenant from that of Sergeant, was killed in action recently. In a report submitted to the Mayor the following encomiums were passed upon him:

"He was twenty-nine years of age, and had been in the council's service nine years. He was an exceedingly capable engineer, with an all-round experience, very steady and reliable, very strong and very patient, courteous, and tactful. He was greatly respected and loved by his colleagues in every department of the council's service, and he was a clean, bright, manly gentleman, a vigorous athlete, a fine shot, and in every respect a true Englishman."

A Montreal Store and Apartment House

PROBABLY the finest provision store in Montreal has been built on Mansfield Street, from designs by Mr. Marius Dufresne, of Maisonneuve. The basement and ground floor are for Stanford's, Limited, and the remaining storeys constitute an apartment house. The site is 44 feet by 96 feet, and as will be seen from the cut, the building is not very high.

Provision Store and apartment house, Mansfield Street, Montreal

The store is designed to include every convenience for the sale of meat and provisions. Lightness and cleanliness were the main desiderata, and so tiles are extensively employed. The exterior is particularly attractive, the use of ornamental ironwork giving the structure an appearance not usually associated with stores of this character.

The foundations presented a difficulty owing to the soft nature of the soil. It was found necessary to sink sixteen concrete piles to rock—a distance of 32 feet below the sidewalk level. Reinforced concrete beams were placed on top of the piles to support the main walls. The basement is of concrete and the floors are of the same material, with the frame of steel. The exterior facing Mansfield Street is built of Indiana limestone, lined with terra cotta, with a granite base. The side walls are of plastic brick and terra cotta, and the back wall is of cream color Greendale Rug Brick lined with terra cotta.

The basement contains a 30-ton capacity cold storage plant, the arrangement including four large freezing rooms, in which the temperature can be regulated by valves from zero to 33 degs. At the back of the basement is the furnace room and the coal bins. The ground floor is devoted entirely to the storage, sale, and cleaning of provisions. The walls are made of white tile with a green colored tile for the border, the wainscoting being of marble. The floor is also tiled, while the ceiling is of plaster. The counters are arranged on either side and at the end, leaving a wide space in the centre for the free movement of customers.

The meat counter is on the south side, and behind this and nearer the walls are arranged the spaces for storing the meat after it is cut. The spaces are separated from the counter by large glass windows, with doors at intervals; thus, if a customer is to be served, the clerk steps into the storage room and obtains whatever is required. On the north side there is the fish counter, provision being made for a cleaning room entirely shut off from the counter by means of walls, but easily accessible to the clerks. This cleaning room is provided with zinc basins and hot and cold water. The shipping room is at the extreme end of the floor, and access is given to the basement by means of a chute.

The main entrance is on the south side. The door is of ornamental iron, while the vestibule has a tiled floor and marble wainscoting. Inside, there are two other doors made of panelled oak. Entrance to the apartment house is obtained by an ornamental ironwork door on the north side. This door and its companion is of an elaborate and beautiful design. The vestibule floor is of tile, and the wainscoting of oak panels, with a design in plaster above the wainscoting. Two electroliers on posts are placed just inside the vestibule. Marble steps lead from the vestibule, through a door made of oak, to the landing, where the wainscoting is of panelled oak. The apartments, six on each floor, are reached by a wide spiral staircase made of oak. This leads to a balcony on each floor, which runs round a light and ventilation wall, reaching from the ground floor to the roof. The balcony, which is protected by an iron balustrade, gives access to each set of apartments. Light at night is afforded by electric globes mounted on posts at intervals. Every balcony is made of concrete with terrazo finish and marble borders. In the centre of the court on the first floor is an ornamental fountain. Each set of apartments consist of four rooms—a kitchenette, dining room, bedroom, bathroom, and a large wardrobe. The doors leading from the balcony are of oak, the interior woodwork being of mahogany, and the bedroom of white enamel.

On the ground floor level, covering the entrances and the window in the centre (used for store purposes) is a large ornamental iron marquee, with a glass roof and glass pendants, supported on four iron brackets. Each of the windows above, belonging to the apartments, has an ornamental iron grille. At the rear end of the building is a fire escape, reaching from the roof to the lane level.

The store is provided with a parcel carrier on a belt conveyor enclosed in oak, for the purpose of conveying parcels from the clerks to the shipping room.

The following firms supplied materials and equipment, and carried out sections of the work: Ornamental ironwork, Canadian Architectural Ironworks; insulation of walls in basement and store, Canadian Johns-Manville Company, Limited; refrigeration plant, Canadian Ice Machine Company, Limited; concrete foundations, brick walls, and setting of stone, A. Choquette; woodwork, manufactured and set up by I. Allard; tile work, Hamon & Hess; roofing, M. Chouinard; steel frame, Dominion Bridge Company; stone cut by the Morrison Quarry Company; Greendale Rug brick, Webster & Sons, Limited; painting and glazing, L. Bourdon; heating and plumbing, Paquette & Fortin; main stairs built by O. Bergeron; plastering, J. Lefebvre.

Mortar Quantities for Block and Brick

The following query was propounded recently by a contractor of Medicine Hat, Alta.:

> "I have always felt somewhat in doubt when it has come to figuring out the exact quantities of materials (cement and sand, or lime and sand) for making the mortar needed for building a block or brick wall. Various thicknesses of joint are specified in different cases, and this must make some difference in the amount of mortar necessary—more difference in the case of brick than with block, because brick, being smaller, require more joints in the same size wall; but I have never felt sure of my ground in trying to allow for the difference. I wish you would tell me if any rules have ever been given for figuring these quantities exactly. Also tell me how many block or brick an average workman can lay in a 10-hour day."

The answer, given by a writer in The Cement World, contains points of general interest:

Answer—The number of cubic feet of mortar required for laying 1,000 brick (common or face) with joints of varying thickness, is as follows:

Joint	Mortar per M. Brick
3/16 in.	8 cu. ft.
¼ in.	10 cu. ft.
5/16 in.	12 cu. ft.
⅜ in.	15 cu. ft.
½ in.	18 cu. ft.
⅝ in.	22 cu. ft.
¾ in.	26 cu. ft.

To lay 1,000 brick in cement mortar (mixed 1 part cement to about 3½ parts sand), with joints ⅜ to ½ in., will require 1¼ barrels (5 sacks) of cement and 18 cu. ft. of sand.

To lay 1,000 brick in lime mortar (mixed 1 part lime to 5 parts sand), with joints ⅜ to ½ in., will require 3 bushels quicklime and 18 cu. ft. of sand.

One bricklayer who is a "good mechanic" (laying steadily and working in a fairly fast gang), with a hod-carrier to deliver the brick, will lay about 1,500 brick in a 10-hour day in an ordinary wall. In face or front work, he will lay 1,000 to 1,200.

In block work, ordinarily, the thickness of joints does not vary, ¼ in. being the standard used in estimating. Inasmuch as a standard 8 x 8 x 16-in. block, allowing for a ¼-in. joint, is equivalent in displacement to 14.22 common brick 2¼ x 4 x 8 in., and a mason should lay up 2 to 3 blocks in the time required for placing 14 brick, it follows that a block wall of any size should be built in 1/ to ½ the time that would be needed for brick construction.

About 100 blocks a day will be laid by a common mason, though first-class men have laid 125 to 150 in a day.

We find, or on investigation, that the cost of block-laying varies considerably. Blocks have been laid as cheaply as at 2 cents each; but we prefer to make a conservative estimate by placing the average cost at 5 cents per block.

Where bricklayers' wages range from 65 to 75 cents an hour, common brickwork is laid at $5 to $7 per thousand, depending upon the construction and thickness of the wall. Face brick cost $15 to $25 per thousand to lay, depending on the number of openings and the general construction. These prices include hod-carriers' and mortar mixers' wages, which are about half those paid to bricklayers.

Concrete Architectural Stone, Building Block, and Brick

DETAILS of practice in the manufacture and testing of concrete architectural stone, building block and brick are contained in a report recommended for adoption by the American Concrete Institute. The sections dealing with the proportions of the various materials and their mixing are valuable, while the whole report is of an essentially practical character calculated to be of especial interest to manufacturers and contractors.

Materials

1. **Cement.**—The cement shall meet the requirements of the Standard Specifications for Portland Cement, adopted by the American Society for Testing Materials, August 16, 1909, with all subsequent amendments and additions thereto adopted by said Society. (Standard No. 1).

2. **(a) Fine Aggregate.**—Fine aggregate shall consist of sand or screenings from hard, durable crushed rock or gravel, consisting of quartzite grains or other equally hard material graded from fine to coarse, with the coarse particles predominating. Fine aggregate, when dry, shall pass a screen having 4 meshes per linear inch; not more than 25 per cent. should pass a sieve having 50 meshes per linear inch; and not more than five per cent. should pass a sieve having 100 meshes per linear inch. Fine aggregate should not contain vegetable matter, no more than three per cent. of clay or loam. In no case should fine aggregate containing frost or lumbs of frozen material be used.

Fine aggregate shall be of such quality that mortar composed of 1 part Portland cement and 3 parts fine aggregate, by weight, when made into briquettes, shall show a tensile strength at least equal to the strength of briquettes composed of 1 part of the same cement and 3 parts standard Ottawa sand by weight. The percentage of water used in making the briquettes of cement and fine aggregate shall be such as to produce a mortar of the same consistency as that of the Ottawa sand briquettes of standard consistency. In other respects, all briquettes shall be made in accordance with the Report of the Committee on Uniform Tests of Cement, of the American Society of Civil Engineers.

(b) Coarse Aggregate.—Coarse aggregate should consist of clean, hard, durable, crushed rock or gravel, graded in size, free from vegetable matter, and should contain no soft, flat, or elongated particles. In no case should coarse aggregate containing frost or lumps of frozen material be used. The maximum size of the coarse aggregate shall be one-half the thickness of the minimum wall section. Material should range from the maximum size down to not more than 5 per cent. passing a screen having 4 meshes per linear inch.

(c) Natural Mixed Aggregates such as bank-run gravel, or artificially prepared mixtures of fine and coarse aggregate such as crusher-run stone, should not be used, but should be screened over a ¼-in. screen, and remixed to agree with the proportion as specified.

3. When color is required, only the most permanent and durable mineral colors should be used, and same should be considered as aggregate.

4. **Water** should be clean, free from oil, acids, strong alkalis, or vegetable matter. An automatic measuring device should be used to measure the amount of water used in each batch of concrete; and after the desired consistency has been determined, this amount should be used in each batch until working conditions demand a change.

Proportions

5. For architectural stone without mortar face, concrete should be mixed in proportion of 1 bag of Portland cement to not more than 2 cu. ft. of fine aggregate and 3 cu. ft. of coarse aggregate. For architectural stone with mortar face, the backing of concrete should be mixed in proportions of 1 bag of Portland cement to not more than 2½ cu. ft. of fine aggregate and 4 cu. ft. of coarse aggregate; the mortar surface should be mixed in proportion of 1 bag of Portland cement to not more than 2 cu. ft. of fine aggregate.

For concrete block containing no coarse aggregate, the concrete should be mixed in proportion of 1 bag of Portland cement to not more than 3 cu. ft. of fine aggregate. For concrete block with or without mortar face, in which coarse aggregate is used, concrete should be mixed in proportions of 1 bag of Portland cement to not more than 2½ cu. ft. of fine aggregate and 4 cu. ft. of coarse aggregate. Facing for concrete block should be mixed in proportion of 1 bag of Portland cement to not more than 2 cu. ft. of fine aggregate.

For brick in which no coarse aggregate is used, concrete should be mixed in proportion of 1 bag of Portland cement to not more than 3 cu. ft. of fine aggregate. For brick in which coarse aggregate is used, concrete should be mixed in proportion of 1 bag of Portland cement to not more than 2 cu. ft. of fine aggregate and 3 cu. ft. of coarse aggregate.

A bag of Portland cement, 94 lbs. net, shall be considered 1 cu. ft. The method of measuring the materials for the concrete shall be one which will insure separate and uniform proportions of each of the materials at all times. When cement in bulk is used, the cement shall be accurately measured in such manner as will insure that the measured amount of cement used as the equivalent of 1 bag shall be 94 lbs.

Mixing

6. Mixing. The materials should be mixed to the desired consistency in a batch mixer of approved type, and the mixing should continue for at least one minute after all materials, including water, are in the mixer.

7. Retempering of mortar or concrete which has

partially hardened—that is, remixing with additional materials or with water—should not be permitted.

8. Consistency. For architectural stone, concrete should be mixed wet enough that water will freely flush to the surface with slight tamping.

For building block made by hand or power tamping, concrete should be mixed as wet as practicable to use in the ordinary make of block machine and allow immediate removal of the finished block from the mold. For concrete block made under pressure, concrete should be mixed wet enough that a slight excess of water will be ejected from the block when pressure is applied. For concrete block made by the wet process, concrete should be wet enough to fill all parts of the mold immediately without tamping, but not wet enough to cause the mortar to separate from the coarse aggregate.

For brick, concrete should be mixed as wet as possible to use in the ordinary machines in which brick are made by hand or power tamping, or by the application of pressure. Sufficient water should always be used to slightly flush to the surface under tamping or pressure.

Water Work

9. No architectural stone, building block, or brick should be made when the temperature of the atmosphere surrounding the machine or mold is lower than 50 degrees F. Aggregates and water should be heated when the temperatur of either is lower than 50 deg. F.

Curing

10. Steam Curing. Immediately after completing the manufacture of architectural stone, building block, and brick, they should be placed in a curing chamber where the temperature is not lower than 50 degrees F., and protected from draughts of air and from all exposure which will tend to cause evaporation of moisture from the concrete. Within twelve hours after removing architectural stone, building block, and brick from the place of manufacture, the temperature in the curing chamber should be raised to between 100 and 130 degrees F., and an atmosphere saturated with water vapor maintained by introducing water vapor from a boiler into the curing chamber. This water vapor should be introduced through a perforated pipe laid, with perforations down, in a trough of water in the floor of the curing chamber.

(a) When the outside temperature during the daytime does not fall below 50 degrees F., architectural stone, building block, and brick shall be steam-cured, as described above, for not less than forty-eight hours, after which they may be removed from the curing chamber and piled in the yard. They shall be sprinkled not less than three times daily for seven days. They may be used after having lain in the yard not less than fourteen days.

(b) When the temperature of the outside atmosphere falls below 50 degrees F. during the daytime, architectural stone, building block, and brick shall be steam-cured for not less than 96 hours, after which they may be piled in the yard. They need not receive any further treatment, but shall remain in the yard for not less than fourteen days.

In the steam-curing process, two requirements should be observed, as neglect of these sometimes causes improper curing. First: the steam-curing chamber should be so tight as to prevent circulation of air and the consequent existence of a heated atmosphere not thoroughly saturated with water vapor, which would result in evaporation of water from architectural stone, building block, and brick. Second: steam should not be allowed to enter the curing chamber under pressure in such a manner as to strike the green architectural stone, building block, and brick. The effect of this is to heat them quickly and cause evaporation of water from the product, resulting in ultimate destruction.

11. Natural Curing. When it is found impracticable to introduce water vapor into the curing chamber, architectural stone, building block, and brick should be handled in the same manner as previously described for steam-curing in Paragraph 10, until they have become sufficiently hard so that the application of water does not injure the surface. Architectural stone, building block, and brick should then be kept constantly wet on the surface by sprinkling with water for not less than seven days for Case (a) and fourteen days for Case (b); and the temperature should be maintained at not less than 70 degrees F. in the curing chamber. After removal from the curing chamber, architectural stone, building block, and brick should be treated as already described for steam-curing in Paragraph 10; that is, the period of storage in the yard should be not less than fourteen days.

Reinforcement

12. Architectural stone and flat building units subjected to cross-bending shall be reinforced by means of rods placed about 1½ in. from the tension surface; and the total sectional area for the reinforcement shall be not less than 8/10 of 1 per cent. of the cross-sectional area of the concrete in the member reinforced. When any dimension exceeds eight times the least dimension of any member, such member shall be reinforced to insure safety in handling.

Finishing, Marking, and Handling

13. Finishing. Architectural stone, building block, and brick may have exposed surfaces treated by any of the various methods proposed by the Institute in the recommendations for treatment of concrete surfaces. All surfaces and arrises should be true and without imperfection.

14. Marking. Full standard size should be marked for the purpose of identification, showing name of manufacturer or brand and date (month and year) made.

15. Handling. Architectural stone, building block, and brick should be handled with utmost care. When transported and subjected to rough handling, they should be crated and packed in non-staining material in such a way as to insure no damage from chipping or abrasion. All large and heavy units should be provided with hooks for lifting. When necessary, the units should be provided with metal bonds for the purpose of tying to the masonry backing.

16. Architectural stone, building block, and brick not usually being subjected to tensile stresses, their testing is ordinarily limited to compression and absorption.

Properly made architectural stone, building block, and brick should—at an age of 28 days—sustain without failure a load of 1,000 lbs. per sq. in. of gross area as placed in the wall, making no allowance for hollow space.

After being dried to constant weight at a temperature of 212 degrees F., architectural stone, building block, and brick 28 days old should not show more than 5 per cent. absorption after immersion in water for 48 hours.

Method of Keeping Sewer and Other Records*

By R. H. Boynton†

ONE of the most important, but usually most neglected parts of the routine work of the city engineer in the small city is the keeping of office records. It is a difficult thing, as a rule, to convince the members of the common council of the importance of keeping a complete record of everything. Usually the records have been neglected so long that the members of the council view the necessary expenditure to bring them up to date as a needless waste of money. Then often the engineer, when he contemplates the vast amount of work necessary to start a set of records and complete them, is overwhelmed and gives up the idea. His predecessors in office had been too careless or too lazy to keep up the records and he feels that he is not bound by any rules to do another man's work.

Possibly the greatest cause, next to the two mentioned above, for neglecting the records is that when the engineer should be compiling his records, he is busily engaged in outside work endeavoring to piece out his salary. Salaries somewhere nearer in proportion to the duties and responsibilities placed upon the engineer would remove the incentive to seek outside work and thus give him more time for routine office work.

It is my intention to discuss briefly a system of office records that has been devised for my office at Frankfort and which we are now trying to perfect. The most important requirement of a system of office records is that they be elastic to take care of the future growth. This requisite is met by means of card indexes, loose-leaf binders and sectional cabinets. Filing space can be provided as needed and arranged to suit the demands.

Filing Cards

The most important thing in the records is a good index to enable one to find any desired information in the quickest possible time. This must be extremely elastic. In indexing our office, we adopted the card index, using 3 x 5 in. cards and one-third cut guides. We adopted the street subdivision and I believe it to be the best for city work, as 95 per cent. of the data in the engineer's office relates to streets. Each street has a guide behind which are filed all index cards referring to that street.

The data referring to alleys gave us considerable trouble, but finally we hit upon the scheme of referring all north and south alleys to the first street east of them and all east and west alleys to the street north. I might remark that nearly all streets in Frankfort run east and west and north and south. The alley cards are filed behind a guide marked "Alleys" and are further subdivided by means of an alphabetical set of guides. Behind each letter are filed all cards of alleys that are referred to streets the first letter of which is that letter. For miscellaneous data, subject guides were used, such as ordinances, corporations, pavements, sewers, etc. The index was further subdivided by the use of colored index cards. All data relating to improvement of streets or alleys are placed on buff cards, those relating to sewers on salmon, those relating to openings, vacations, etc., on green, those relating to grades and grade lines on cherry, those relating to property on blue, and unclassified data on white cards. Any particular subject or improvement is placed on one card with sufficient notes to make it easily found and on this card are given the file numbers of all data relating to this subject.

Drawing Files

All maps, plans, profiles, etc., are filed in a large cabinet containing several drawers, to each of which is assigned a capital letter. Each drawer is subdivided, where necessary, into compartments, to which are assigned lower-case letters. The drawings, etc., are assigned consecutive numbers in each compartment. This gives a file number consisting of a capital letter, a lower-case letter, and a number. All these are filed flat unless the size prohibits.

Document Files

Resolutions, specifications, etc., relating to improvements are also filed in this cabinet. All such data of any particular piece of work are placed in a folder to which is assigned a file number consisting of drawer capital letter, two figures to show the year, and a decimal. The decimal begins at one each year and runs consecutively through the year. On the outside of each folder is an abstract of each step in the proceeding, showing reference to the record of the council proceedings, where full proceedings can be found. These folders were made from heavy bill-poster paper purchased at a local printing office. As the assessment rolls are referred to most frequently in the future, they were placed in another drawer and were given the same file number as the folder for the improvement to which they refer, except, of course, a different drawer letter was used.

Sewer Records

The most important record drawing is the sewer record. The present record consists of a bound book of profile-plan paper, but we have started work on a new record, which will be in a loose-leaf binder. On this record are shown the plan, profile, abutting tracts of land, location of each house connection, all appurtenances, character of soil, etc. In Frankfort no house can be connected to a sewer until the engineer issues a permit. These permits show the plumber making the connection, who is under bond, the person for whom the connection is made, and what it is proposed to connect. These permits are numbered consecutively and as each connection is made, the permit number is shown on the sewer record and the permit filed away.

Record Maps

Record maps are made up on small scale plats of the entire city and are mounted on rollers which are hung on the wall. These maps are seven in number. First is a sanitary sewer map on which are shown all sewer lines in service, with the sizes, kind, grades, year built, etc. Second, a storm sewer map, with the same data as above. Third, a water-works and heating line map, on which, in red, are shown the mains of the Frankfort Water Works Company, with all appurtenances, size and kind of mains, year laid, etc. In green are shown the mains of the Frankfort Heating Company, with similar data as above. Fourth, a gas, telephone and other sub-surface structure map, with complete data, different colored ink being used to distinguish them. Fifth, a street improvement map, showing the kind of curb, walk and pavement on each street and alley. Sixth, a property map, to which I will refer later; and seventh, a monument and bench-mark map, of which I also say more later.

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*From a paper presented at a meeting of the Indiana Municipal League. Abstracted by Engineering and Contracting.

†City Engineer of Frankford, Ind.

In connection with the above record maps is kept a tabulated list of all appurtenances, such as manholes, lampholes, flush tanks, fire hydrants, etc. All these are numbered consecutively in the order they are built, and on the tabulated list are shown all dimensions, date built, references as to location, etc.

Copies of all ordinances relating to the department are filed in a loose-leaf ordinance record. In a similar manner, additions, with their dedications, are filed.

All monuments are numbered consecutively, and a tabulated list is kept on which are shown sufficient notes and ties to enable accurate relocation. Benchmarks are also numbered and the record shows the latum plane, elevation, location and by whom set.

A copy of the ordinances establishing grades is filed in a grade ordinance book, in connection with which are grade sheets drawn to scale.

Property Record

In most of our cities the engineering department is also the assessment bureau. Possibly in other counties in the state the records in the county auditor's office are in such shape that a person can find property owners at a faster rate than about ten per hour, but not so in Clinton County. Last winter we started work on a property record and now have it nearly complete. For this work 5 x 8 in. cards were used, on the face of which appear the addition (of platted ground), block and lot number, owner's name, a brief description and reference to the deed record in the county recorder's office. On the back are shown all special assessments made against the property. These cards are filed in a card index cabinet behind guides showing the addition. The filing of the unplatted tracts of ground presented a rather difficult problem, which was solved by the use of large-scale standard maps in connection with the property record map. The entire city was divided into 37 divisions of such size that when platted on a scale of 1 in. to 100 ft. the standard maps were about 16 by 25 ins. Each division was numbered and each tract within the division was given a letter. This method resulted in giving the same ease in locating an unplatted tract as is usually expected for platted tracts. These cards are filed behind guides numbered to correspond to the divisions. The deeds are copied on 3 x 5 in. cards and filed behind guides numbered to correspond to the deed record in a card index transfer case. This method of filing the deeds was used only after experimenting with bound books and loose-leaf binders. The keeping of this record requires about one hour per week and has proven itself to be one of the most useful records in the office.

This briefly covers what records we are at present endeavoring to keep up and they seem to cover our local conditions very well. I feel that the necessity of complete, well-kept records in the engineer's office cannot be over-estimated. The first thing is to start a system early and the second is to keep everlastingly at it. Do not let it get ahead of you. If you do not find a system of records in your office, take off your coat and wade in.

It is often necessary to temporarily divert small streams of water, particularly in bridge and culvert work. It is stated that strips of canvas tacked to rough supports so as to make a V-shaped trough are ideal for this purpose, as they are inexpensive, compact, flexible and quickly placed.

Contrasts in Pile-Pulling Methods

CONTRASTING methods in pulling piles are analysed by a writer in a recent contribution to Engineering Record. A gallows frame with a derrick luffed to the heavy pulley tackle, is looked upon by many contractors as the best means of pulling piles under ordinary circumstances; nevertheless, piles are sometimes pulled with a lever and a gin-pole, says this writer. At first sight the lever method would appear the best, as with a moderate size lever and a 5-ton derrick, where there is a good "heel" close to the line of sheeting, a pull of 80 tons can be readily developed. To pull 80 tons with an ordinary hoist requires at least 16 parts of line, and a heavy frame or gin-pole. As a matter of actual fact, a pull of 40 tons, possible with eight parts of line with a frame made of 12 x 12-inch timber, will draw out a sheet pile which cannot be budged with a lever of double the power. The reason here suggested is that the frame can be spotted to pull in direct blocking slips, or the lever in rising changes slightly in line of pull. Besides, it is difficult to adjust a hitch from the lever to the pile which will not throw undue strain on some one part—while the lever is more cumbersome to handle than a gin-pole or gallows frame.

A gallows frame is much stronger than a gin-pole, and is more easily set up, as it need be guyed normal to one plane only, while a gin-pole must be guyed in all directions. A short gallows frame was used for pulling steel sheeting on a St. Louis well foundation job which had braced sills under the posts, and required no guys. Where there is a place to set such a machine up it will pull piles faster than any other rig.

The riggers who advocate the gin-pole claim a longer pull without changing the hitch on the pile, as a gin-pole can be conveniently made taller than a frame. This is often a disadvantage, however, as when it comes time to drop the hitch, the hitch is inaccessible without some climbing, having been pulled up out of reach; and hitches will not always shake loose as they should. As a matter of fact, the heavy pulling hitch need only be used for the first 10 feet, after which the derrick can pull the piles direct.

In reeving up the heavy falls for pulling long sheet piles, four to six sheave blocks should be used, depending on the power of the derrick. These blocks should always be rove from the centre—that is, the lead line should enter the lower block on one of the centre sheaves. If the blocks are rove in the ordinary way, the tilt of the blocks is under strain, and consequent friction loss in the rope, takes all the strain out of the standing part and the parts next to it. This loads the blocks eccentrically, and will tear the lower blocks to pieces, if of ordinary construction, before three piles have been pulled.

The Manitoba scandals should make all public bodies far more careful in their dealings. They have to spend large sums of money, and in the exercise of their normal duties they become responsible to the people for what are nothing more or less than trust funds. No man should hold a position of public trust or responsibility if his private interests run counter to his public interest. "Man cannot serve God and Mammon" is not at all a bad motto for any public official.

Types of Construction Camp Garbage and Refuse Incinerators

The following rules have been laid down for the disposal of garbage and refuse in construction camps:

1. Kitchen garbage and refuse should be kept in fly-proof containers, preferably metal, until permanently disposed of. Such containers should be emptied at least once in two days.

2. Fly-tight receptacles should be provided, convenient to the sleeping quarters, for the collection of waste such as paper, cast-off clothing, etc.

3. All garbage should be disposed of either by incineration, by burying, or by feeding to hogs. Hogs should not be allowed within a quarter of a mile of camp. Garbage should not be fed to chickens as they will not consume it all, thus affording fly breeding and feeding places.

4. Incinerators for the burning of garbage and waste can be easily and cheaply constructed.

Six types of construction camp incinerators are illustrated and described herewith.

Chimney Type—Fig. 1 shows a chimney type incinerator for a camp of 2,000 persons. This can be built of rock, cobblestones or old brick by unskilled labor. In California such an incinerator can be built at an estimated cost, for labor and material, of the brick type for $137 and of concrete type for $144. For a permanent camp the incinerator should be built of either concrete or brick and lined with fire brick.

The bill of material for the chimney type of incinerator is as follows when constructed of brick: 800 fire brick, 2,500 common brick, 1,800 lbs. grate bars or old rails, 36 cu. ft. excavation. When built of concrete: 24 cu. ft. excavation, 128 cu. ft. concrete, 120 lbs. reinforcing steel, 800 fire brick, 1,800 lbs. grate bars or old rails. The bill of platform material is as follows: 4 pieces 4 x 4 in. by 7 ft. wooden posts, 2 pieces 4 x 4 in. by 6 ft. wooden girders, 115 lin. ft. 2 x 6 in., wooden joists and braces, 30 lin. ft. 2 x 12 in. plank flooring, 20 lin. ft. 2 x 12 in. stair stringers, 30 lin. ft. 2 x 12 in. stair treads, 44 lin. ft. 2 x 4 in. braces and supports, 9 lin. ft. 2 x 3 in. sized hand rail, 4⅝ by 5 in. bolts, 10 lbs. 20d nails.

Stack Type—Figure 2 shows a stack type of incinerator for a camp of 150 people. The pan shown is 8 ins. in depth and is used to evaporate liquid slops, while the solid garbage is placed on top of the fuel. By treating the liquid thus separately, a great deal of fuel is saved.

The bill of material, using brick, is as follows: 144 fire brick, 330 common brick, 20 cu. ft. excavation, 225 lbs. of old rail or grate bars, 22 sq. ft. of No. 24 galvanized iron for stack. When using concrete: 20 cu. ft. concrete, 144 fire brick, 20 cu. ft. excavation, 225 lbs. old rails or grate bars, 22 sq. ft. No. 24 galvanized iron for stack, 1 piece wrought iron plate 26 x 26 ins., 21 sq. ft. sheet metal for pan.

The estimated cost of this type of incinerator for labor and material is as follows for California conditions: brick type $36.50, concrete type $34.

Barrel Type—Fig. 3 shows a barrel type of incin-

Types of Construction Camp Garbage and Refuse Incinerators

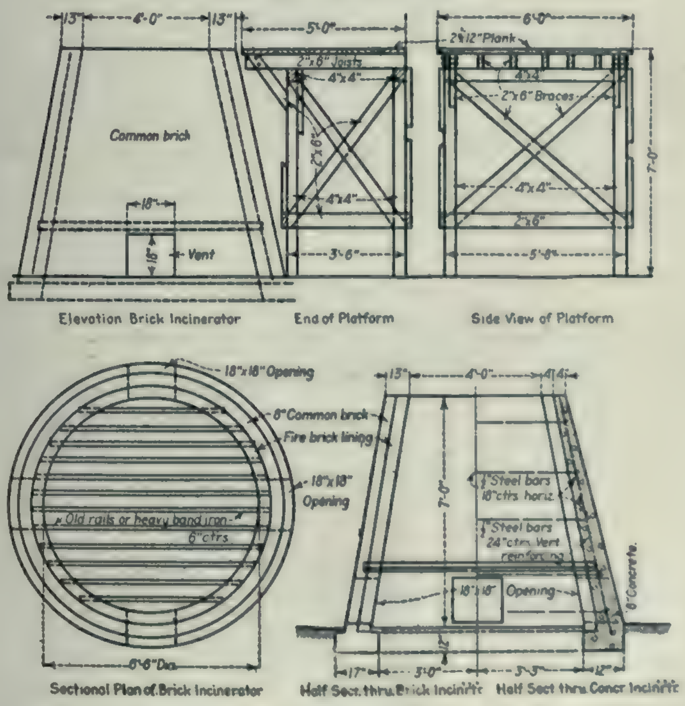


Fig. 1.—Details of construction camp incinerator of the chimney type.

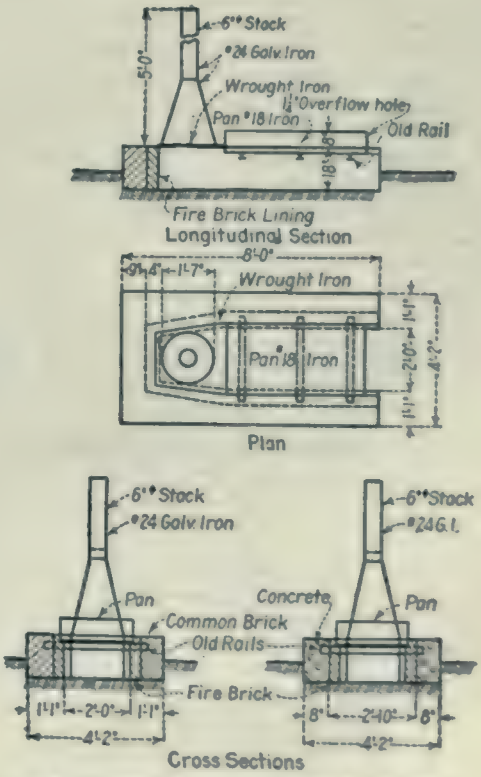


Fig. 2.—Details of camp incinerator of the stack type

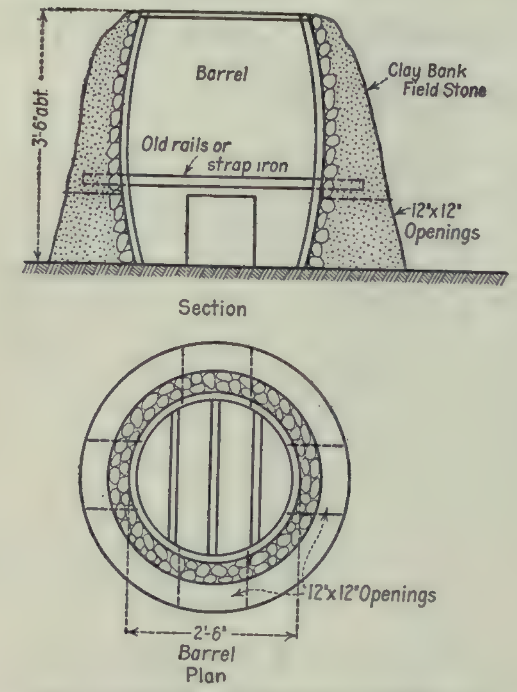


Fig. 3.—Details of camp incinerator of the barrel type.

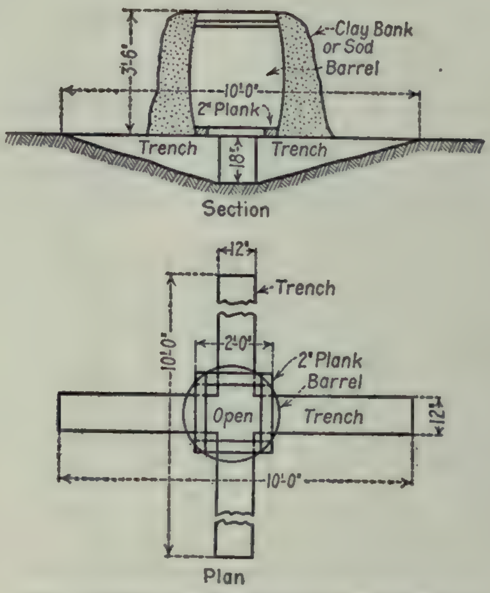


Fig. 4.—Details of camp incinerator of the barrel and trench type.

erator suitable for a camp of 125 persons which can be built at the following cost:

1 common flour or sugar barrel	$0.50
Placing clay	3.00
Old rails or scrap iron	0.50
Incidentals	2.00
Total	$6.00

Barrel and Trench Type—Figure 4 shows a barrel and trench type of incinerator suitable for a camp of 115 persons. This incinerator can be constructed in the following manner. Dig two trenches 10 ft. long and 10 or 12 ins. wide, bisecting each other. At the point of bisection the trenches should be from 15 to 18 ins. deep, gradually shallowing from this point to their origin. Over the place of bisection place four boards to support an ordinary sugar or flour barrel. Around the barrel pile sods of earth and pack tightly up to the top of the barrel. If sods are not obtainable use clay. Make a fire in the trench under the barrel and when the barrel is burned out a hard cone of earth or clay is left.

In operating this type of incinerator one trench opening near the cone is left uncovered, according to the direction of the wind, and the other three are plugged with soil. Thus a flue is formed through the one opening and raked out at the end of each day's use and a fresh fire started in the morning. Fuel and garbage are fed to the fire through the top of the cone.

1 cu. yd. excavation	$1.00
1 common sugar or flour barrel	0.50
Placing clay or sod	4.00
Incidentals	.50
Total	$6.00

Rock Pile Type—Fig. 5 shows a rock pile incinerator which can be installed very cheaply if rock is available on the ground. This incinerator is suitable

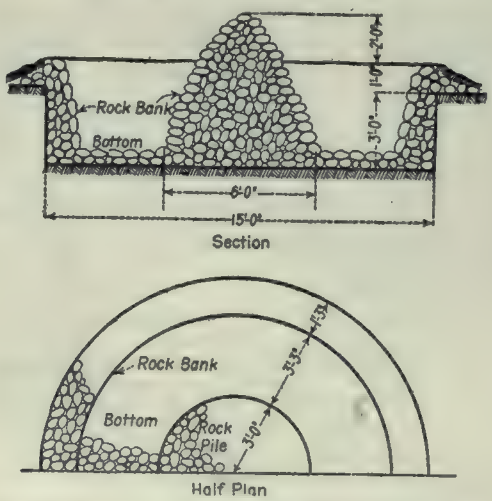


Fig. 5.—Details of camp incinerator of the rock pile type.

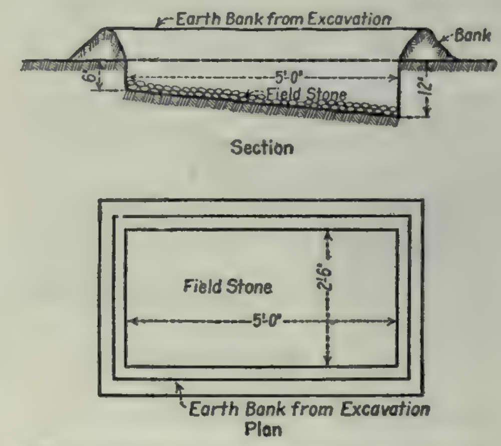


Fig. 6.—Details of camp incinerator of the pit type.

for a camp of about 2,500 persons. Construct as follows:

At some convenient point dig a circular pit 3 ft. in depth and 15 ft. in diameter. Cover the bottom with loose stones to a depth of 14 to 16 ins. On this build a circular wall to a height of 1 ft. above the original ground line and pack tightly the excavated earth around the wall so as to provide a sloping approach, thereby preventing surface water from gaining access to the pit. Build a pyramid of large stones 4 or 5 ft. high in the center to provide a central draft. The head of the bottom stones evaporates the liquid slops while the solids are soon consumed as fuel for the fire. Precautions should be taken to empty the garbage into the crematory and not around it.

The estimated cost of the rock pile incinerator is as follows:

22 cu. yds. excavation	$22.00
Placing rock in place	15.00
Gathering and hauling stone	9.00
Cement	4.00
Total	$50.00

Pit Incinerator—Fig. 6 shows a pit incinerator suitable for a camp of 250 people which is constructed as follows:

Dig a pit 5 x 2½ ft. by 6 ins. deep at one end and 12 ins. deep at the other. Bank the excavated earth around the pit and fill it with stones on which to build the fire. When the stones have become heated, liquid refuse is poured into the pit at the shallow end where it gradually evaporates. Solid garbage is burned on the fire.

The estimated cost of the pit incinerator is as follows:

Excavation	$1.00
Placing field stone	1.50
Incidentals	.50
Total	$3.00

This information is abstracted in a recent issue of Engineering and Contracting from an advisory pamphlet on Camp Sanitation and Housing issued by the Commission of Immigration and Housing of California, San Francisco.

The roof construction of a small demonstration building that remained undamaged through the severe tornado of March 27, at Adel, Iowa, is described in the July number of The Brick and Clay Record. It is of hollow brick construction and self-supporting, the load being carried by bricks which were keyed to form a complete arch. The walls of the structure were carried up to the top course in the usual manner, after which a special cornice block was laid. An extra heavy band of plow steel was carried around this and a single row of brick was tamped in against it, firmly embedding it into the wall, as a reinforcement against the thrust at the heel of the arch formed by the roof. The bricks were then laid in concrete, each course being completed before the next one was laid.

The use of concrete for roofs has simplified the waterproofing problem. Instead of using 5-ply roofing paper, 3-ply will be found ample. The saving from this source often exceeds 2c. per sq. ft., or $600 on a mill 75 ft. x 400 ft. The two extra plies used on a wood roof are needed to make a smooth surface, but the concrete roof is already smooth.

Refuse Destructors

THE primary object of refuse destructors is the effectual disposal of town refuse on sanitary lines and at reasonable cost. An instructive article on this subject by Mr. R. O. Wynne-Roberts appeared in our issue of September 16, 1914. In this article Mr. Wynne-Roberts classified furnaces having a temperature less than 1,500 degrees Fahrenheit as incinerators, and those having a higher temperature as destructors.

It is essential that some such distinction should be made, as the results to be obtained are different for each type. Probably some of the incinerators now in use would soon be damaged if temperatures of 1,500 degrees and over were maintained in the combustion chambers, while destructors again would become inefficient with a lower temperature.

Ordinarily, incinerators and destructors are differently constructed in many respects, and the terms of the contract should be arranged accordingly.

Where cities require incinerators, then, the temperature in the combustion chamber should be maintained at, say, 1,250 degrees, but the standard of efficiency should also be modified. The gases of combustion as they pass through the main flue to the chimney will have a much lower percentage of carbon dioxide, owing to the large quantity of air consumed and the low temperature. The quantity of steam generated per pound of ordinary refuse will be low, and the percentage of such steam power required to operate the blowers, etc., will be high. Moreover, the refuse itself is of such a variable character that short period tests are hardly reliable as indications of what to expect under normal working conditions. In the case of destructors there is a tendency to adopt mechanical methods of charging and clinkering. The more mechanical a plant becomes the more it needs mechanics in its operation.

The article already referred to deals with this feature of destructors. There is no doubt that where there are capable mechanics employed, and the refuse is amenable to such handling, considerable economy in working expenses can be and is effected. Such destructors would ordinarily be found only in larger cities.

The terms of the contract, therefore, should be controlled by the requirements of the city authority. Not only is it unfair to the contractor to have to endeavour to meet stringent conditions that are not attainable in ordinary daily operation, but it is costly and unsatisfactory to the rate-payers. On the other hand, the designers and contractors of incinerators and destructors are inclined to claim qualities for their plant which in actual practice are difficult to realize. If, then, they claim these qualities, it is natural to expect the city engineer to insist upon their fulfilment, and it is in this way that troubles often ensue.

The San Francisco example is one to avoid. There the city authority imposed stringent conditions, and the contractors, according to press reports, promised great things. In neither case were these exactly fulfilled—with the result that the city rejected the plant after paying a part of the contract price, and the contractors were faced with the loss of reputation and also a heavy monetary loss. This is bad for the city and bad for the contractor. There may be strong reasons for rejecting the plant. The contractors may have undertaken to do the impossible, in the hope that the conditions might be interpreted generously. Whilst this is the position in this instance as we understand it at present, there are on the other hand examples where plants have been erected and accepted without proper tests, only for the authorities to find later on that their efficiency is not what it should be. With experiences of this kind it is not surprising that other authorities, fortified by this knowledge, impose conditions which are too stringent.

Deeds of contract should be drawn up so as to cover what is reasonably expected to be obtained. Contractors should undertake what they are prepared to fulfil.

Contractor's Use of Turntable

Confronted with the problem of unloading industrial cars into an end loading mixer with track and mixer both on subgrade, an Illinois highway contractor building a State-aid concrete road north of Chicago on Milwaukee Avenue successfully solved his difficulty by placing a turntable in front of the mixer skip. About 1,000 feet from the mixer a switch is placed, affording a double track to the turntable, at which point the tracks are joined again by means of a frog. As a result one track can be used for loaded cars and the other for sending back empties. As the contractor has only one engine on the job, cars are pulled to and from the turntable by a horse, the engine used to bring the material from the railroad to the switch. Upon arriving at the switch the engine is detached and run onto the siding, picking up its train of empties. The loaded cars are then pulled by the horse to the turntable. The turntable is attached to the mixer by means of a steel strut. At the railroad each hopper car is loaded by hand with enough sand and gravel for a batch for the 1-yd. mixer. Cement is placed on flat cars in sufficient quantities to allow six bags per car for each hopper car in a train, and is transferred at the lower end of the switch from flat cars on the siding to the hopper cars on the main track. As a rule six bags are used per batch but this is changed according to the condition of the stone. The average train consists of from fifteen to twenty cars. About sixty-five cars and 4¼ miles of track are in use. The dead haul is 1.6 miles and the average haul 3.85 miles.

Painting Steel Before Embedding in Concrete

The suggestion has often been made that steel should be painted before being embedded in concrete, with the idea of protecting the metal from corrosion. An investigation of this proposal has been conducted by Mr. H. A. Gardner, of the Institution of Industrial Research at Washington. One of the results brought out was the statement that painting may have a distinctly prejudicial effect. One serious objection to the use of paint in reinforced-concrete is its interference with the natural adhesion bond between the steel and the concrete. It is true that painted surfaces may be improved by being coated with crushed quartz or fine sand, but even then the presence of the paint is objectionable because it is interposed between two materials capable of entering into chemical combination, resulting in the formation of a rust-resisting compound which aids very greatly in the efficiency of the bond.

Personal Mention

George Neil, who had been engaged in the contracting business at Winnipeg for the last fourteen years, died last week in the western metropolis.

Mr. George W. Tillson, of Brooklyn, N. Y., and Mr. E. L. Powers, of New York City, respectively President and Secretary of the American Road Builders' Association, visited Victoria, B. C., recently en route to the engineering conference at San Francisco. While in Victoria they were entertained by City Engineer Rust.

At Ste. Cecil de Leonard, Que., a civil engineer, J. J. Scott, of the Department of Militia and Defence, recently lost his life in attempting to rescue a farmer who, in digging a well, had struck a vein of natural gas and had been overcome. Mr. Scott descended into the well to a depth of about fifteen, when he was overcome and fell to the bottom.

Pro Patria

LIEUT.-COL. Robert Walter Paterson, who went to England with the First Canadian Expeditionary Force in command of the Fort Garry Horse, and who is now stationed at Canterbury, England, was Secretary-Treasurer of the Winnipeg Paint and Glass Company, Limited, Winnipeg. Born at Guelph in 1876, Col. Paterson was educated at the Ottawa Collegiate Institute. He entered the Bank of Ottawa as a junior in 1894, and went to Winnipeg in 1902. He became President of the Manitoba Linseed Oil Mills and a Director of the Martin-Senour Company, Limited, but outside of these lines, identified with the building field, he had important interests. For instance, he was Vice-President of the Northern Canadian Mortgage Company, President of the Canadian Motor Company, Limited, and a Director of the Notre Dame Investment Company, Limited.

Lieut.-Col. Paterson.

Col. Paterson's military career is an interesting one. At the age of twenty-three he became a lieutenant in the 43rd Regiment, The Duke of Cornwall's Own. Three years later, at Winnipeg, he was a Captain in the 90th Regiment, while from 1907 to 1912 he served as Major in the 18th Mounted Rifles. Finally he succeeded to the command of the 34th Fort Garry Horse.

Lieut.-Col. Paterson has always been devoted to outdoor exercises, and is proficient in riding, shooting, sailing, curling, and other sports. He was married in 1907, and has two sons and one daughter.

Mainly Constructional

East and West—From Coast to Coast

Messrs. A. Heon & Company, with head office at Three Rivers, Que., are a new contracting firm lately registered.

The Laurentide Company, Grand'Mere, P. Q., expect to start on November 1st one of the units of the 125,000 horse power development now being constructed. Two more will be in operation on November 15th and the whole number, six, on January 1st. The cost will be within the $5,500,000 estimated.

Good progress has been made on the theatre which the St. Denis Theatre Company, Limited, are erecting on St. Davis Street at a cost of $300,000. The building is 110 by 205 feet in dimensions, of steel and brick construction. The architects are Messrs. Barnott, Blacader & Webster, and the general contractors Messrs. Norcross Brothers Company, Limited.

At a meeting of the Canadian Railway Club held at the Windsor Hotel on Tuesday, September 14, Mr. William Roger, A.M.Can.Soc.C.E., Elevation Draughtsman for the Canadian Pacific Railway, read a paper entitled "Hydraulic Presses versus Power Presses in Connection with the Manufacture of Cartridges and Shells." The lecture was illustrated by stereoptican views.

Apropos of the present state of the Parliament Buildings work at Winnipeg, it is of interest to know that Messrs. J. W. McDiarmid Company, Limited, of Winnipeg, have been awarded a sub-contract on a five per cent. basis of the actual outlay for labour and material. Tenders for the general contract are to be called during the winter, and work on the completion of the buildings is to start in the spring. The estimated cost of the whole undertaking is $4,500,000.

In contrast to The Robert Simpson Company's award of the contract for their Regina warehouse to a Chicago firm is the award of the Ford Motor Company of a contract for a factory estimated to cost $250,000 to the Carter-Halls-Aldinger Company, of Winnipeg. The Western firm's success is all the more gratifying as the contract was secured in competition with firms from the other side of the border. The new building, which is to be erected at Winnipeg, is to be five storeys high, 204 by 100 feet in dimensions, of reinforced concrete and steel construction.

It is reported that the contract for shells awarded recently to the newly-organized Calgary firm, the Canadian Western Foundry and Supply Company, Limited, is worth something like six million dollars. Announcement of the incorporation of the company was made a short time ago. The firm is capitalized at one million dollars. The organization was created by the merger of the International Supply Company of Medicine Hat, the Western Foundry and Metal Company of Calgary, and the Canadian Equipment and Supply Company of Calgary and Edmonton. There are several plants where a portion of the work will be done, but as yet no details are available. It is suggested that the company may have to erect a new plant in Calgary.

A cement brick machine named the "Little Giant" was featured by the LaGrange Specialty Company, LaGrange, Indiana, at the Toronto Exhibition. The machine is claimed to be the simplest and most compact yet manufactured for the trade. All the tools necessary are a spade, the cement being placed in the machine, which is in the form of a mould. No delay is necessary when the machine is filled and levelled with cement: it is immediately tipped over, the cement dropping out in the form of three complete bricks, all that is then necessary being the curing and hardening process to complete the manufacture. The company claim that with their machine two thousand bricks can be manufactured in a day. The machine can be fitted with various moulds to allow of ornamental work and is adaptable to brick requirements of all kinds. Mr. A. W. Laurie and Mr. C. M. McBride, who were in charge of the exhibit, are the sole Canadian agents.

At the Canadian National Exhibition in Toronto many visitors were attracted by the Toronto Furnace and Crematory Company's Modern Novelty Magazine self-feeder furnaces and Novelty hot water and air combination heaters. By means of the latter, the company state that hot water heating sections can be made proportionate to any number of feet of heating surface, guaranteeing even heat distribution throughout the whole system. A specialty of this company's manufacture is their Modern steel-clad incinerator, the entire outside of which is cased in heavy steel plates, strengthened by heavy angle and tee irons carried horizontally and vertically through the construction. The company issue a very interesting catalogue setting forth the various points of advantage in their incinerators and is well worth the small trouble of obtaining. The company's incinerators are designed specially for housing and approaches, hospitals, hotels, abbatoirs, factories, and for all places where a constant and large system of sanitation in the destruction of garbage is needed.

Trade Enquiries

THE following inquiries relating to Canadian trade have been received by the Department of Trade and Commerce at Ottawa. Those especially interested in the respective commodities can obtain the names and addresses of inquirers by writing to the Inquiries Branch of the Governmental Department mentioned above, by communicating with the Secretary of the Canadian Manufacturers' Association, Toronto, or by getting in touch with the Secretary of the Board of Trade at London, Toronto, Hamilton, Kingston, Halifax, Montreal, St. John, Sherbrooke, Vancouver, Victoria, Winnipeg, Brandon, Edmonton, Calgary, Saskatoon, Chambre de Commerce de Montreal, and Moncton, N. B.

987. **Machine wire, iron tubing, brass and bronze waste, etc,**—A French importer desires to get in touch with persons able to supply the above, which hitherto have been obtained in Germany and Austria.

988. **Nails, screws, bolts and nuts, brushware, step ladders, shovels, etc.**—A firm in Johannesburg desires to receive catalogues and quotations f. o. b. Montreal from Canadian Manufacturers of nails, screws, bolts and nuts, brushware, step ladders, lanterns, shovels, patent roofing, pick-handles, hammer-handles, etc.

990. **Lumber, doors, door frames, window frames, etc.**—A Johannesburg firm desires to receive quotations f. o. b. Montreal from Canadian manufacturers of lumber, doors, door frames, window frames, etc.

994. **Builders' supplies.**—A Cape Town agent handling builders' supplies only, for Cape Town and district, is prepared to consider offers of agency in lumber, timber, hardware and builders' supplies of all kinds.

The city of Edmonton has started work on the construction of sewage disposal works estimated to cost $30,000 on 101st Street. The work is being done by day labour under the supervision of the City Engineer, Mr. A. J. Latornell.

Mr. M. J. O'Brien, of Renfrew, Ont., one of the biggest railroad contractors in the country, was taken ill with peritonitis recently. At the time of writing he is in the Victoria Hospital, Montreal.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Brooke Township, Ont.
Township Council are considering extensions and repairs to the Parker Lucas Drain. Clerk, W. J. Weed, Inwood, Ont.

Dover Township, Ont.
Tenders on the construction of a pumping plant and for dredging will be received until noon, September 22nd, by Commissioner James St. Pierre, R. R. No. 1, Bear Line, Ont. Plans and specifications at offices of the Clerk Township Clerk, James Fox, Electric, Ont., the Engineer, W. G. McGeorge, 153 Queen St., Chatham, and of the Commissioner.

Galt, Ont.
The Town Council have decided to lay storm and sanitary sewers on one of the streets. Engineer, C. D. Campbell. Approximate cost, $3,400.

The construction of a sewer and storm drain on a part of Cedar Street has been recommended by the Board of Works. Town Clerk, Joseph McCartney.

The Town Council are considering the construction of cement sidewalks on a number of streets. Clerk, Joseph McCartney.

Hull, Que.
The City Council have authorized Engineer J. P. A. Laforest to obtain prices on the construction of sewers on Chaplain and Bridge Streets and on paving a portion of Victoria Street.

New Glasgow, N. S.
The Town Council have decided to call for tenders immediately for the extension of the sewer on Trenton Road. Engineer, E. S. Fenser.

New Toronto, Ont.
The Councils of New Toronto and Mimico have decided upon the construction of a joint sewage system. Work will consist of a pumping station, disposal and treatment plant to be erected at the foot of Superior Avenue, Mimico. Tenders will be called shortly.

Ojibway, Ont.
The Town Council propose to construct a tile drainage system at an early date. Clerk, J. Moynahan, 21 Parent Avenue, Windsor.

Peterborough, Ont.
The City Council contemplate the laying of asphaltic concrete pavement on Hall and Hunter Streets and of concrete sidewalks on a number of streets. Clerk, S. R. Armstrong.

Point Grey, B. C.
Work is about to start on the re-surfacing of that portion of Imperial Street between Fourth Avenue and Marine Drive. Engineer, W. B. Greig.

Preston, Ont.
The Town Council are having plans prepared for a sanitary sewer to be laid on King Street. Clerk, H. C. Edgar. Engineer, C. S. McKenzie.

Saanich, B. C.
The Municipality are considering grading and paving portions of Douglas St. and Gorge Road, at an estimated cost of $24,500. Clerk, Hector S. Cooper, Municipal Hall, Royal Oak, B. C.

St. Cecille de Whitton, Que.
The Muniripal Council are considering the construction of a water-works system. Secretary, J. G. Beaudoin.

Toronto, Ont.
Tenders on the construction of sewers on Chambers, Howick, Lansdowne, Prescott, Silverthorne and Turnberry Streets will be received until September 28th by the Board of Control. Plans at office of the Works Department, City Hall.

Wellesley Township, Ont.
Tenders on the construction of the Linwood Municipal Drain will be received until 4 p.m., September 18th, by the Reeve, A. B. Robertson, P. O., Wellesley.

West Oxford Township, Ont.
The Township Clerk, Bryon G. Jenvey, R. R. No. 5, Ingersoll, will receive tenders until noon, September 21st, for the construction of the Charles Wilson Drain. Plans and specifications at office of the Clerk.

Winnipeg, Man.
City Engineer W. P. Brereton has recommended that the grade of a portion of North Main Street be lowered, and estimates the cost at $10,500. Secretary to the Board of Control, M. Peterson.

CONTRACTS AWARDED

Cartierville, Que.
In connection with the filtration plant being constructed for the Town Council, the sub-contract for the intake pipe has been let to R. T. Smith & Company, 27 Hillside Avenue, Westmount. Metal and concrete construction.

Fort Erie, Ont.
The contract for laying 1,000 feet of concrete roadway and surbs has been let by the Municipal Council to the Maple Leaf Paving Company, Simcoe, Ont., at $5,460.

Ingersoll, Ont.
The Town Council have let the contract for the extension of the concrete pavement, curbs and gutter on Thames Street to the Municipal Construction Company, Berlin.

Leamington, Ont.
Work will start at once on the laying of a reinforced concrete pavement on Erie Street for the Town Council. The contract has been awarded to Scratch & Link, Leamington. Approximate quantity, 8,386 square yards.

London, Ont.
The contract for laying sewers on Quebec, Reyburn and Salisbury Streets has been let by the City Council to John McMurphy, Hyman Hall, Queen's and Park Avenue.

Norwich South Township, Ont.
The contract for the supply of tile for the Hanson Drain has been let by the Township Council to F. Blair, and for trenching and laying of tile to J. S. Hutchinson.

Point Grey, B. C.
A contract for laying pavement on Fourth Avenue has been let by the Municipal Council to Cotton & Company, Ltd., 1830 Granville Street, Vancouver, and to Ledingham & Cooper, 423 Hamilton Street, Vancouver.

Sarnia, Ont.
The following contracts for paving and concrete sidewalk have been let by the City Council:—Harkness Street, Cuttridge & Grace, River Front; Blanche Street, Frank Wales; Divine Street, John J. Chester; Maxwell Street and Ross Avenue, George Elderidge & Company, 326 Durand Street.

St. Catharines, Ont.
The City Council have awarded the contract for the construction of paying and reinforced concrete sidewalks on the St. Paul Viaduct to Brayley Nicholson Company, 61 Proctor Boulevard, amilton, at $30,000.

Toronto, Ont.
The following contracts for the construction of pavements and sidewalks has been let by the Board of Control:—asphaltic concrete pavements, Godson Contracting Company, Manning Chambers, $3,132, and Contracting and Paving Company, Confederation Life Building, $3,425; brick block pavements, Grant Contracting Company, 50 Front Street E., $5,680, and Asphaltic Concrete Company, 74 King Street E., $8,430; concrete sidewalks, Moyes Construction Company, 592 Gerrard Street E., International Contractors, Ltd., 2459 Yonge Street, Ramsay Contracting Company, 39 Indian Road Crescent, Godson Contracting Company, Manning Chambers, Grant Contracting Company, 50 Front Street E., Queen City Concrete Paving Company, 179 Broadview Avenue, and A. Johnson, 35 Burgess Avenue.

The Board of Control have let contracts to Commissioner of Works R. C. Harris for the construction of bitulithic pavements on a number of streets at $43,377, and for asphalt pavements at $52,450.

Winnipeg, Man.
The contract for the supply of 29,000 square yards of granite paving blocks for the Main Street subway has been let by the Board of Control to Bannerman

& Horn, 126 Polson Street, at $2.30 per square yard.

York Township, Ont.
The following contracts for paving and sidewalk have been let by the Township Council:—asphalt pavement on Ravensden Avenue, Godson Contracting Company, Manning Chambers, Toronto; concrete sidewalk on Oakwood Avenue, A. Johnson, 35 Burgess Avenue, Toronto; concrete sidewalk on Conway Ave., Brayley & Nicholson, 61 Proctor Boulevard, Hamilton.

Railroads, Bridges and Wharves

Alberta Province
The Grand Trunk Pacific Railway, Montreal, have been authorized to construct interchange tracks between their line and the Canadian Pacific Railway at the Globe Elevator Site for the City of Calgary. General Manager, M. Donaldson, Winnipeg.

The Edmonton, Dunvegan & British Columbia Railway intend to continue the construction of their tracks this year as far as Murray's. President, J. D. McArthur, Edmonton.

Hamilton, Ont.
The E. T. Wright Company, 48 Cathcart Street, propose to construct a spur line from the Grand Trunk tracks along Kelly and Cathcart Streets to their plant.

Hull, Que.
The Canadian Pacific Railway Company have been authorized to construct an industrial spur for the Hull Iron & Steel Foundries Ltd. Head office of company, Montreal.

Manitoba Province
The Board of Railway Commissioners have empowered the Canadian Pacific Railway Company to build a spur across the road between Sections 28 and 21. and across the transmission line of the Winnipeg Electric Railway Company on the southwest quarter of Section 28.

Norwich Township, Ont.
The Grand Trunk Railway Company have been authorized to construct an extension of their branch line to the premises of the Borden Milk Company, Ltd., Lot 10, Concession 5, Norwich Township.

Owen Sound, Ont.
The Grand Trunk Railway Company are receiving tenders from local contractors for the rebuilding of the wharf. Wood construction. Approximate cost, $10,000. Head Office of Company, Montreal.

Saskatchewan Province
The construction of a branch line from the Grand Trunk Pacific Railway to the Board of Grain Commissioners' Elevator at Moose Jaw has been authorized.

CONTRACTS AWARDED

Bienville, Que.
The erection of a school is contemplated by the School Board, and a site has been selected. Secretary, Louis Begin.

Cardston, Alta.
Contracts for plumbing, heating, ventilating and trimming at the school now in course of erection will be let by the general contractor, H. A. Christensen, Cardston.

Darlington Township, Ont.
The contract for the erection of three cement bridges has been let by the Township Council to Joseph Chatworthy, Hampton, Ont.

Esquimalt, B. C.
The Town Council are about to submit two by-laws, of $15,000 each, for the erection of a fire hall and for the purchase of equipment, including motor truck and wagon, with triple combination hose, chemical hose and accessories. Clerk, G. H. Pullen.

Simcoe, Ont.
The general contract for the construction of the Argyle Street bridge has been let by the Lake Erie & Northern Railway to Johnson Bros., 41½ Market Street, Brantford. Estimated cost, $4,600.

Public Buildings, Churches and Schools

Fairbank, Ont.
The Trustees of School Section No. 15, York, have purchased a site for a school. Secretary, W. Deacoff, Fairbank.

Halbrite, Sask.
The seating for the school now in course of erection will be purchased by the School Board.

Kingston, Ont.
The erection of a shelter for children is being considered by the Children's Aid Society, City Buildings.

Quebec, Que.
The Young Men's Christian Association propose to erect a new building on the site of the old Tara Hall, Ste. Anne Street.

Rosemount, Que.
Tenders on the erection of a school will be received until noon, September 17th, by the Secretary to the School Commissioners, H. Hardy, 2538 Rosemount Boulevard. Plans and specifications at office of the Architect, J. O. Turgeon, 55 St. Francis Xavier Street, Montreal.

Rosser Township, Man.
The by-law to provide for the erection of a school has been defeated.

Roylston, B. C.
Tenders on the erection of a one-roomed school will be received until noon, September 21st, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at the Department, Victoria.

St. Albert de Warwick, Que.
All work on the church now in course of erection for the Roman Catholic Congregation will be done by the general contractor, L. Caron, Nicolet.

Tilbury, Ont.
Tenders will be called soon for the erection of a library, estimated to cost $5,000. Architects, Adams & Adams, Box 72, Chatham. Brick construction, cement block foundation, galvanized iron roofing.

Vanderhoof, B. C.
Tenders on the erection of a school will be received until noon, September 24th, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of J. Mahoney, Government Agent, Vancouver, T. W. Herne, Government Agent, Prince George, J. S. Ruttan, Secretary to the School Board, Vanderhoof, and at the Department.

Waldo, B. C.
The Deputy Minister of Public Works, J. E. Griffith, Victoria, will receive tenders until noon, September 21st, on the erection of a school and outbuildings. Plans and specifications at offices of J. Mahoney, Government Agent, Vancouver, G. S. Stalker, Agent, Fernie, W. Madden, Secretary to the School Board, Waldo, and at the Department.

Wiarton, Ont.
The Board of Education are considering an addition to the High School and the installation of a lavatory system. Architects, Forster & Clark, 887 Second Avenue E., Owen Sound.

Youngstown, Alta.
The Town Council are considering a by-law providing for the erection of a fire hall and purchase of equipment at an approximate cost of $8,400. Clerk, F. E. Snell.

CONTRACTS AWARDED

Ethelbert, Man.
Work is about to start on the erection of a hospital for the Presbyterian Women's Missionary Society. The general contract has been awarded to W. J. Wright, Prince Albert, Sask. Estimated cost, $8,500.

Hamilton, Ont.
The roofing contract in connection with the Mountain View Hospital now in course of erection has been let to Thomas Irwin & Son, 22 McNab Street South.

In connection with the addition now being built at the hospital on John St. S., the contract for painting has been let to the general contractors, James Frid & Company, Ltd., Bank of Hamilton Building.

The following contracts have been awarded in connection with the lodge hall being built on Main Street E. for the Independent Order of Oddfellows:—roofing, Dennis & Jocelyn, Walnut St. W.; plastering, R. Hull, 381 East Avenue N.; plumbing, W. Backalake, 12 Picton Street E.; electrical work, D. Dalgelish, 93 prospect Street.

Lachine, Que.
The City Council have let the contract for the erection of Fire Station No. 3 on Tenth Avenue to Josephat Theoret, 46 Fourteenth Avenue, at $17,775. Brick construction, stone trim, concrete foundation, felt and gravel roofing.

London, Ont.
The masonry contract in connection with the church now being built on Maitland Street by the Latter Day Saints has been let to Charles Insell & Son, 1003 Maitland Street, and the contract for electrical work to the People's Electric Company, 641 Dundas Street.

L'Orignal, Que.
The general contract for the erection of an addition at the Home of Refuge

(Continued on page 53)

Tenders and For Sale Department

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, September 20, 1915**, for the construction of Concrete Sidewalk on Gledhill Avenue, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, Sept. 13, 1915. . 37

NAVAL SERVICE OF CANADA

Sale by Tender of C. G. S. "Lady of The Lake."

Sealed tenders addressed to the undersigned and accompanied by a certified cheque for Two Hundred Dollars ($200) will be received up to noon on **Thursday, the 7th day of October, 1915**, for the purchase of the Canadian Government Steamer "Lady of the Lake," lately employed in Fishery Patrol duties on Lake Winnipeg and now lying at the Government Wharf, Selkirk, Man.

The dimensions of the steamer, which was built in 1897 are:—Length 105, Breadth 18 feet, 5 inches, and depth 8 feet 9 inches. Her gross tonnage is 201 tons and her net tonnage 155 tons. She is fitted with steeple compound engines, cylinders 11 inches and 19 inches diameter, 15 inch stroke and a locomotive type boiler.

Form of tender, conditions of sale, full particulars of the Steamer, and permission to inspect her may be obtained on application from the undersigned or from the Inspector of Fisheries, Selkirk, Man.

Unauthorized publication of this advertisement will not be paid for.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service.
Ottawa, August 31st, 1915.
84903— 36-37

For Sale

The machinery and equipment of the Chatham Electric light plant, consisting of:—

2 Hornsby-Stockport horizontal gas engines, 100 h.p. each.

2 Hornsby-Stockport suction gas producers complete with scrubbers.

1 Hornsby-Stockport gasoline driven air compressor with air tank.

3 Western Electric d.c. generators, 3300 v., 8 amp., 50 light each.

1 Sheldon's Ventilating Fan No. 7.

50 Adams-Bagnall 8 amp. d.c. series arc lamps.

Offers will be received for the complete plant or any part thereof.

F. P. ADAMS, City Engineer,
36-37 Chatham, Ont.

Contractors Plant For Sale

The Corporation of the City of Victoria, B. C., have a large quantity of contractors' plant for sale, consisting of dinkey engines, dump cars, about 450 tons of 20-lb. rail, hand cars, hoisting engine, pipe, etc. A complete list of the above equipment, and any further information may be obtained upon application to the office of the City Purchasing Agent, City Hall, Victoria, B. C.

Victoria, B.C., August 27th, 1915. 36-38

Tenders for Sewerage and Water Supply

The municipalities of Mimico and New Toronto are prepared to receive tenders for the following works:—

Contract No. 1.—Sewers and Water Mains.

Contract No. 2.—Sewage Disposal Works.

Contract No. 3.—Supply of Sanitary Vitrified Pipes.

Contract No. 4.—Sewage Pumping Station.

Quantities and notice to bidders may be obtained and specifications and plans examined at the office of the Engineer, T. Lowes, 186 King Street West, Toronto.

The Engineer will attend at 10 a.m., Tuesday, the 21st inst., at stop 12, Mimico, to meet intending bidders and show them over the ground.

Tenders to be sent in not later than noon, **Friday, the 1st of October next**, sealed and addressed to J. A. Telfer, Clerk to the Municipality, Mimico, Ont.

C. COXHEAD, Reeve, Mimico.
G. IRONSIDE, Reeve, New Toronto.
September 15th, 1915. 37

Late News Items

Eureka, N.S.

Tenders on the erection of an extension to the mill of the Nova Scotia Underwear Company are being received by the Architect, J. W. Mackay, Scotsburn, N.S. Plans and specifications at offices of the Architect and of the Rhodes Curry Company, South Street, New Glasgow. Frame construction.

Leamington, Ont.

Bulk or separate tenders on the erection of a parsonage are now being received by the Ontario University Convention. Building Committee, Aylmer Burk, Peter Apcott and George J. Porter. Frame construction, concrete foundation.

Marquette Station, Man.

Tenders on 24,000 yards of grading and ditching for the Municipality of Rosser will be received until September 18th by the Secretary, W. A. Beachill, Rosser. Plans and specifications at office of the Secretary.

Montreal, Que.

Work has been started on the erection of six residences and three stores for Joseph Leclaire, 600 Demontigny Street E. The general contract has been let to Euclide Riendeau, 553 Garnier St. Approximate cost, $14,000.

Fire has destroyed the Crescent Garage and adjoining premises at 660-670 St. Catherines Street W., the property of J. H. Maher, 120 St. James Street. Loss, $60,000.

Roxborough Township, Ont.

The Township Clerk, F. D. Brunet, Moose Creek, will receive tenders until 1 p.m., September 20th, for the construction of 27,200 feet of drain and of one concrete and one cedar bridge. Plans and specifications at offices of the Clerk and of the Engineer, F. M. Eagleson, Winchester.

Toronto, Ont.

The contract for plastering at the office building in course of erection on University Avenue for the Provincial Hydro Electric Commission has been awarded to R. C. Dancy, 153 Spadina Rd.

Tenders are being received by T. R. Morris, 150 Roxton Road, for masonry and brickwork required in the erection of a store and apartments at Danforth and Langford Avenues.

Vercheres, Que.

Tenders on the installation of a hot water heating system at the Municipal Building will be received until 1 p.m., September 25th, by the Secretary, Marius Laporte. Plans and specifications with the Secretary.

Winnipeg, Man.

The Board of Control will receive tenders until September 20th for the supply of 2,400 feet of cast iron water pipe, class C, delivered f.o.b. cars at Winnipeg City Yards, freight and duty paid. Specifications at office of the City Engineer, W. P. Brereton, 223 St. James Avenue.

Windmill Power Plant for Mission in Arctic Circle

To take advantage of the winds which blow continuously at Mount Hope, a mission settlement 100 miles north of the Arctic Circle, an electric-lighting plant driven by great windmills is to be erected. Four hundred people live at Mount Hope during the long Arctic winter, and as fuel is at a premium there, the steady winds, which seldom fall below twenty miles per hour, are to be used to advantage, it is explained.

Public Buildings, Churches and Schools

(Continued from page 51)

has been let to A. Boyer, c/o C. Brodeur, architect, 63 Hotel de Ville, Hull. Cement and brick construction. Approximate cost, $13,000.

Business Buildings and Industrial Plants

Barrie, Ont.
The erection of a moving picture theatre is being considered by W. D. Minnikin, 227 Elizabeth Street. Estimated cost, $5,000.

Cache Bay, Ont.
George Gordon & Company, Limited, are about to rebuild their sawmill, at an approximate cost of $75,000. Work will start at once under supervision of Alexander Trottier, Cache Bay, Ont.

Campbellton, N.B.
A committee of the Board of Trade is engaged in drawing up a prospectus and organizing a company for the erection and operation of a grist mill. President, J. Blackhall.

Ford City, Ont.
The Ford Motor Company are considering the erection of a factory for the manufacture of farm tractors. Plans are not yet prepared.

Ioco, B.C.
The Imperial Oil Company, Limited, 404 Abbott Street, Vancouver, are about to let a contract for the erection of an office building and club house, estimated to cost $18,000.

Kentville, N.S.
Tenders on the erection of an arena to replace that recently destroyed by fire will be received until September 17th by the President of the Arena Company, T. P. Calkin. Frame construction, paroid roofing.

Magrath, Alta.
The Royal Bank of Canada contemplate the erection of a branch building here. Work will probably commence shortly. Head office of company, Montreal.

Morris Township, Ont.
The erection of fireproof farm buildings is contemplated by Henry Hopper, Concession 1, Morris Township, Wingham. Estimated cost, $3,000.

Mount Bridges, Ont.
The Crow Motor Company are considering the erection of a factory for the manufacture of automobile motors. Approximate cost, $10,000.

Preston, Ont.
Jacob Werlich, Shantz Block, is about to remodel and fit up certain premises as a large furniture warehouse. Alterations will include new store fronts and interior appointments.

Quebec, Que.
Plans are being prepared for a store and residence to be erected for J. N. Rondeau, 6 Lachevrotiere Street, at an approximate cost of $6,000. Architect, L. A. Robitaille, Lindsay Building, St. John Street. Brick and frame construction, concrete foundation.

Rockland, Ont.
The erection of a store and residence has been commenced by H. Beaulne.

Thorold, Ont.
Lorne D. Haist, R. R. No. 1, Thorold, Ont., is considering the rebuilding of his barn, at an approximate cost of $3,000.

John Welch, 108 Hiawatha Avenue, has commenced the erection of a pair of stores at 1420 Gerrard Street E., estimated to cost $5,500. Tenders on all trades required are now being received. Brick construction.

Grimshaw Bros., 34 Brookmount Rd., are receiving tenders for electric wiring at three stores at 1830 Queen Street E.

Vancouver, B.C.
Tenders for marble tile, marble base and hardware for the bank building now in course of erection at Pender and Main Streets are being received by W. F. Gardiner, Supervising Architect, 347 Pender Street.

Winnipeg, Man.
The establishment of an aviation school is being considered, and the Provincial Government have guaranteed $10,000 for this purpose. Further particulars from Thomas Rowland, Industrial Commissioner, Main Street.

CONTRACTS AWARDED

Bothwell, Ont.
The general contract for the erection of a branch building for the Merchants Bank of Canada has been let to P. H. Secord & Sons, Limited, 133 Nelson St., Brantford. Tenders on plastering, roofing, heating, plumbing and electric wiring will be called shortly. Approximate cost of building, $8,000. Previous report incorrect.

Brantford, Ont.
The contract for the installation of a sprinkler system at the store in course of erection at Colborne and Queen Streets for the Brethour Estate has been let to Purdy-Mansell Company, 63 Albert Street, Toronto.

Chatham, Ont.
William Robertson, Baxter Street, has commenced the erection of two stores and a pool room for Fred Bates, William Street. Steel and brick construction. Approximate cost, $13,000.

Halifax, N.S.
The plumbing contract in connection with the stores and offices being built on Barrington Street by J. E. Roy has been let to D. E. MacNeil, 26 Argyle St.

Hamilton, Ont.
The contract for steel-work at the theatre being built on King Street E. by Farewell & Guest, 167½ King Street E., has been let to the Hamilton Steel Construction Company, Lottridge Street, and for electrical work to E. S. Jarrett, 304 Wilson Street. Tenders are being received for plastering, heating, plumbing and painting.

The general contract for the erection of an addition to the factory of the Hamilton Cotton Company, Mary Street E., has been let to W. Yates, 24 Leeming Street. All trades will be sub-let by the general contractor.

Maxville, Ont.
Work has been started on the erection of a milk depot for the Borden Milk Company, Limited, 11 Place Royal, Montreal, Que. The general contract has been let to Ronald Cameron, Maxville. Frame construction, concrete foundation. Estimated cost, $10,000.

Montreal, Que.
Work has been started on the construction of a wagon shed for the Imperial Oil Company, Limited, 918 St. Patrick Street. The general contract has been let to James Shearer & Company, Limited, 225 St. Patrick Street. Galvanized iron and steel construction, concrete foundation and floors.

Port Colborne, Ont.
The general contract for the erection of a skating rink for the Port Colborne Athletic Club has been let to A. Sweet, King Street, at $8,000. Contractor is in the market for lumber and galvanized iron.

Preston, Ont.
Work has been started by Samuel Branch on the remodelling of a garage for Nafe Bros.

Quebec, Que.
T. Mathieu, 109 Third Avenue, Limoilou, has commenced the erection of a warehouse for Germaine Lepine, 281-283 St. Valier Street. Frame and brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $6,000.

St. Catharines, Ont.
The general contract for the construction of lavatories and baths at the Grand Central Hotel for J. S. Campbell has been let to O'Gorman & Hemphill, 39 Geneva Street, and for bar lavatories to John Nichols & T. Messler. Architect, T. H. Wiley, 128 St. Paul Street.

Tavistock, Ont.
Jacob Seltzer is building a furniture store for John and Louis Krug, estimated to cost $3,500.

Wallaceburg, Ont.
Work has been started on the erection of an addition to the factory of the Wallaceburg Cut Glass Works, Duncan Street. General contractor, A. Gregory, Dresden.

Winnipeg, Man.
The general contract for the erection of a factory on Portage Avenue for the Ford Motor Company of Canada, Ford City, Ont., has been awarded to Carter Halls Aldinger Company, 1010 Union Bank Building. Reinforced concrete and steel construction. Approximate cost, $250,000.

Simmons Bros., 1200 Garfield Street, have commenced the erection of a milk depot for the Board of Control. Estimated cost, $7,500.

Residences

Brandon, Man.
W. W. Wade & Son, are building a residence on Princess Avenue, estimated to cost $3,500. Frame construction, shingle roofing.

Dartmouth, N.S.
The Victor Woodworks, Park Road, Amherst, have commenced the construction of a residence on Stairs Street. The erection of ten or twelve of these houses is contemplated. Estimated cost, $2,500 to $3,000 each.

Hamilton, Ont.
The erection of a residence on St Clair Street is contemplated by J. M.

Farewell, 167½ King Street E. Brick construction, concrete foundation, shingle roofing. Estimated cost, $4,500. Plans have been prepared.

Andrew Hyslop, Greensville, Ont., is receiving tenders on wiring five houses on Mary and Emerald Streets.

Plans have been drawn for a residence to be built on St. Clair Street by J. M. Farewell, 230 King Street E. Brick construction, concrete foundation, shingle roofing. Estimated cost, $4,500.

Plans have been drawn for two residences to be built by J. Dwyer, 55 East Bend Street, at an approximate cost of $2,000 each. Brick construction, concrete foundation, shingle roofing.

The contract for electrical work at the residence being built on Emerald Street S. for William Laking, 324 Victoria Avenue W., has been let to Electric Supply Company, James Street S.

Lachine, Que.
In connection with the flats being erected on Seventh Avenue by I. Stein, 1528 Cadieux Street, Montreal, tenders will be called shortly for roofing, plastering, heating, plumbing, gas and electric fitting.

Listowel, Ont.
Daniel Damm, Raglan Street, has commenced the erection of a residence on Penelope Street, estimated to cost $3,000. White brick construction, shingle roofing.

London, Ont.
John M. Parsons, 379 Wellington St., contemplates remodelling two residences, at an approximate cost of $3,000. Work will consist of interior alterations and decoration.

Lucan, Ont.
R. H. Collins has started work on alterations and additions to his residence. Frame and white brick construction.

Montreal, Que.
David Labelle, 2239a St. Dominique Street, is considering the erection of twenty-four flats on Casgrain Street, at an estimated cost of $22,000. Brick construction, concrete foundation, felt and gravel roofing.

Work on the erection of a residence has been started by John Davey, 176 Canning Street. Approximate cost, $4,200.

Ottawa, Ont.
E. B. Butterworth, 197 Sparks Street, contemplates the erection of apartments on Cooper Street. Stucco and brick veneer construction, stone foundation, felt and gravel roofing. Approximate cost, $5,500.

Quebec, Que.
Work has been started by Cleophas Hamann, 96 St. Bernard Street, on the erection of a residence on St. Raphael Street, estimated to cost $6,000. Brick and frame construction, concrete foundation, metal and asbestos roofing.

Michel Bureau, 95 Canardiere Road, is considering the erection of a residence at Ninth Street and Eighth Street, Limoilou, estimated to cost $7,000. Brick and frame construction, concrete foundation, felt and gravel roofing.

Theodule Bernier, 177 Eighth Street, Limoilou, has commenced the erection of a residence on Fourth Avenue, Limoilou. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

The erection of a residence on St. Raphael Street has been commenced by A. Couture, 1121 St. Valier Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $4,000.

David Chevalier, 143 Ninth Street, has commenced the erection of a residence, estimated to cost $5,000. Brick and frame construction, concrete foundation, felt and gravel roofing.

A residence is being built on Ninth St., Limoilou, for Dame G. Moreau, 95 Fifth Street. Brick and frame construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Toronto, Ont.
Joseph Price, 126 Lee Avenue, has commenced the erection of six residences on Lee Avenue, estimated to cost $6,000. Brick construction.

In connection with the residence being built at 208 Albany Avenue by T. A. Dickens, 19 Edgewood Crescent, tenders are being received for plumbing, plastering, hot air heating, drains and installation of gas and electric work.

Tenders on heating, plumbing and plastering at three pairs of residences on Prospect Street are being received by C. F. McConnell, 167 Yonge Street. Plans at Room 8, 167 Yonge Street.

Work has been started on the erection of a residence on Marchmont Road for W. H. Wright, 40 Rosedale Heights. Brick construction, stone foundation. Estimated cost, $5,000.

Tenders for plumbing at four residences on Wolverleigh Boulevard are being received by Orford & Hill, 90 Church Street.

Verdun, Que.
G. W. Julien, 46 Second Avenue, has commenced the erection of six flats on Second Avenue, estimated to cost $5,000. Encased brick construction, felt and gravel roofing.

Geffa Denault, 968 Verdun Avenue, is building three flats on Joseph Street, estimated to cost $3,000. Pressed brick construction, felt and gravel roofing.

CONTRACTS AWARDED

Halifax, N.S.
The following contracts have been let in connection with the residence being built on Larch Street by the Eastern Investment Corporation, Cragg Building, Barrington Street:—heating, Longard Bros., 213 Hollis Street; plumbing, W. S. Craig, 316 Upper Water Street; electrical work, J. Starr Son & Company, Limited, Granville Street.

Hamilton, Ont.
The following contracts have been let in connection with the residence being erected on Burris Analon Place for W. C. Armstrong, 119 Hughson Street:—plastering, Hannaford Bros., 232 Robinson Street; painting, Gibson Bros., 47 Frederick Avenue; heating, R. H. Dow, 15 Bay Street N.; plumbing, J. Saynor, 173 John Street S.

The contract for electrical work at the residence in course of erection on Main Street W. for Miss M. A. Hardman has been awarded to L. H. Lander, 110 King Street W.

Montreal, Que.
The contract for roofing at the residence being built by S. B. White, 906 Compte Street, has been let to D. Nicholson & Company, 837 St. Paul Street.

Hand & Pick, 609 Belmont Avenue, Westmount, have commenced the erection of a residence for J. H. Hand. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $8,000.

Ottawa, Ont.
The general contract for the erection of a residence on First Avenue for E. F. Day, 240 First Avenue, has been let to James Patterson, 873 Somerset St. Approximate cost, $5,500.

Port Elgin, Ont.
D. Taylor, Port Elgin, has commenced the erection of a residence for Mrs. W. Mitchell. Frame and white brick construction, shingle roofing. Estimated cost, $3,000.

Quebec, Que.
Work has been started on the erection of a residence on St. Charles Street for E. Couturier, Fourth Avenue, Limoilou. The general contract has been let to J. E. Boivin, 31 Sixth Avenue, Limoilou. Brick and frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $5,000.

Sarnia, Ont.
The following contracts have been let in connection with the residence in course of erection on Vidal Street N. for H. M. Poussette, 177½ Front Street:—general contract and carpentry, W. D. Shaw, 139 William Street; plastering, F. Gutridge, 109 College Avenue; heating, plumbing and electrical work, F. Lawson.

Toronto, Ont.
In connection with alterations and additions to apartments at 5 Dale Avenue for S. Frank Wilson, the carpentry contract has been let to J. D. Young & Son, 160 Rusholme Road.

Verdun, Que.
Antoine Filiatrault, 393 Lasalle Road, is building five flats on Wilbrod Street for J. Daigneault, 310 Wilbrod Street. Encased brick construction, felt and gravel roofing. Estimated cost, $5,500.

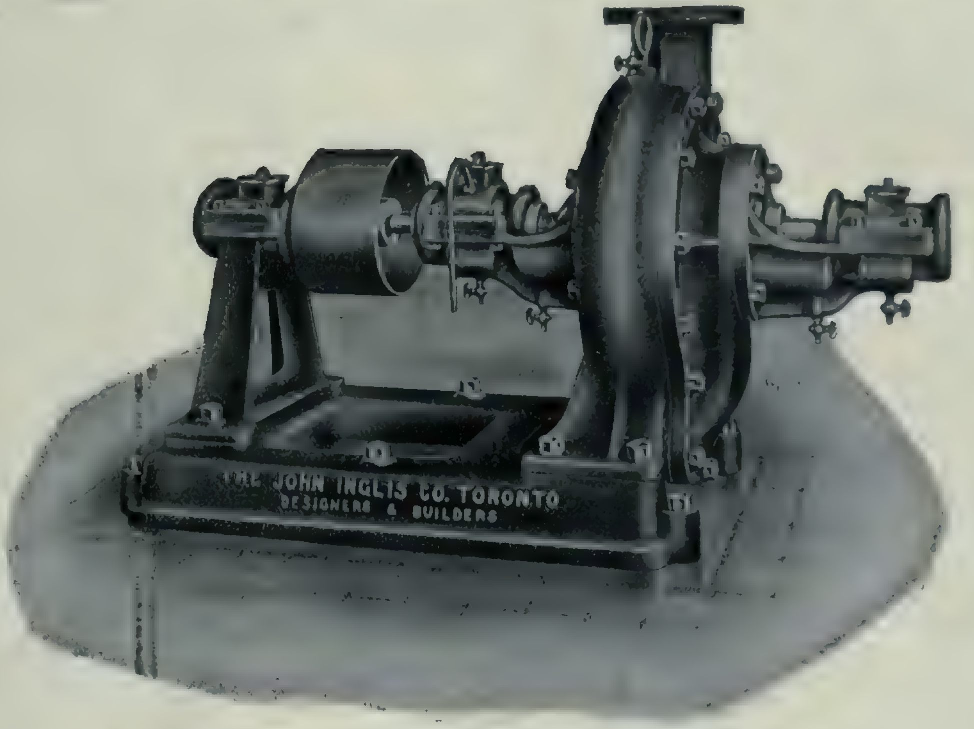
Work has been started on the erection of three flats on Third Avenue for Leopold Marquet, 1106 Mount Royal Avenue, Montreal. The general contract has been awarded to Alphonse Jasoque, 473 Third Avenue, Verdun. Encased brick construction, felt and gravel roofing. Approximate cost, $3,000.

Power Plants, Electricity and Telephones

Brigden, Ont.
A by-law providing for the installation of an engine, dynamo and electric lighting equipment will be submitted to the ratepayers on September 20th. Village Clerk, C. C. Watson. Estimated cost of work, $3,500.

Oakville, Ont.
The Town Council are considering the

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

installation of a lighting system on Main Street. Clerk, W. E. M. Crawley.

Orangeville, Ont.
A by-law has been carried providing for the purchase of the plant of the Pine River Light & Power Company, Limited, and for the purchase of power from the Provincial Hydro Electric Commission. Town Clerk, A. A. Hughson.

Toronto, Ont.
The Ontario Hydro Electric Commission, Continental Life Building, have authorized the following extensions to their lines:—Chatham to Oil City, 25 miles; Granton to Kirkton and Exeter, 25 miles; Lucan to Ailsa Craig, 10 miles.

CONTRACTS AWARDED

Beverly Township, Ont.
The Township Council have let the contract for the installation of a hydro-electric system to Thomas Hull, Lynden, at $4,495.

Bredenbury, Sask.
The Bredenbury Northern Rural Telephone Company have let the contract for the construction of their system to Loptson & Svienson, Bredenbury.

Mount Forest, Ont.
The contract for the construction of an extension to the Mount Forest Rural Telephone Company's system has been let to E. A. O'Brien, Melfort. Approximate cost, $6,500.

Fires

Cape Traverse, P.E.I.
Lord & Company's store has been entirely destroyed by fire. Loss is partly covered by insurance.

Carnegie, Man.
Fire has completely destroyed a store and residence belonging to A. Pierson, Brandon, and occupied by F. Hill. Loss about $4,000.

Cataract, Ont.
Fire has totally destroyed a barn, the property of Johnston Gibson. The loss is partially covered by insurance.

Colborne, Ont.
A business block owned by F. A. Philp has been completely destroyed by fire. Tenants, Cowie Hardware & Plumbing Company, Tool & Simmons, flour and feed merchants, and Thomas Crothers, nurseryman. Loss unknown.

Cowansville, Que.
Fire has destroyed the store and residence belonging to William Oliver. Loss, $15,000, partially covered by insurance.

Douglasburgh, Que.
H. McH. McNeil's butter factory has been destroyed by fire. Loss, $6,000, covered by insurance. Owner will rebuild.

Fernie, B.C.
The residence of D. Griffiths, Victoria Avenue N., has been completely destroyed by fire. Loss is partly covered by insurance.

Fonthill, Ont.
Fire has destroyed a barn and threshing outfit owned by Lawrence Haist.

Giffard, Que.
A residence belonging to A. A. Cantin, 555 St. Valier Street, Quebec, has been destroyed by fire. Owner will rebuild next spring.

Merriton, Ont.
The store and residence of R. Boucock have been entirely destroyed by fire. Loss partly covered by insurance.

Moncton, N.B.
Fire has destroyed the Curling Rink, Mark's Carriage Factory, No. 1 Fire Station, Lea Reade's Livery Stables and other business premises. Loss, $50,000, insurance about $18,000.

Moose Jaw, Sask.
The Skating Rink at Crescent Park, owned by G. K. Smith, 12 Langdon Crescent, has been destroyed by fire. Loss, $7,000, fully covered by insurance. Owner may rebuild on another site.

North Vancouver, B.C.
The residence of J. Blow, Seventeenth Street W., has been partially destroyed by fire. The loss is partly covered by insurance.

Petrolia, Ont.
Fire has completely destroyed the pumping plant of J. & J. Kerr Company, Tank Street.

Rockland, Ont.
A store and four residences, the property of J. Baulne, have been destroyed by fire. Loss, $25,000; insurance, $12,000.

St. Laurent, Que.
Fire has destroyed two residences, the property of W. Bonneau and N. Taillefer. Loss, $8,000. Owners will rebuild.

St. Mary's Prairie, B.C.
George P. Tisdale's farm buildings have been totally destroyed by fire. Loss unknown.

Toronto, Ont.
The roof of St. Francis Roman Catholic Church, Grace and Arthur Streets, has been badly damaged by fire, and the organ entirely destroyed. The loss is estimated at $10,000. Pastor, Rev. W. L. McCann, 15 Grace Street.

Vancouver, B. C.
Fire has destroyed a residence at Shaughnessy Heights, belonging to E. W. McLean, 1638 Angus Avenue. Loss about $5,000.

A store belonging to A. R. McDongall, Fifteenth Avende and Kingsway, has been destroyed by fire. Loss, $5,000, partially covered by insurance.

Winnipeg, Man.
A business block on Bannatyne Avenue has been gutted by fire. The following losses were sustained:—Bright & Johnston, owners, Bannatyne Avenue, $25,000; A. Bright & Son, $80,000; A. L. MacKenzie & Company, $25,000; Jobbin Martin Company, $15,000; Mantel Lamp Company, $6,000.

Fire has destroyed the restaurant owned by Frank Restivo, 347 McDermott Avenue. Loss on building and stock, $65,000, partly covered by insurance.

Miscellaneous

Brigden, Ont.
C. A. Smith is receiving prices, catalogues and other information with regard to brick, glass, hardwood flooring, wood paint, plumbing fixtures, steel tanks, eavetrough, porch and balcony designs.

Cap au Corbeau, Ont.
Tenders on the construction of a wooden lighthouse will be received until noon, September 27th, by A. Johnston, Minister of Marine and Fisheries, Ottawa. Plans and specifications at the Post Offices, Cap au Corbeau, Baie St. Paul, Les Eboulements, La Malbaie and at the Department.

Hamilton, Ont.
The Brayley Nicholson Company, 61 Proctor Street, are in the market for concrete machinery, and desire prices, catalogues, etc.

Lachine, Que.
The Fournier Company, Limited, are receiving prices, catalogues and other information with regard to hoisting apparatus, fire escapes, fireproof doors, skylights and plumbing fixtures.

Redners, Sask.
The Imperial Oil Company intend to erect a number of tanks this fall.

Wallaceburg, Ont.
The Imperial Oil Company propose to erect two tanks, with a capacity of 8,000 gallons each. Head office of company, Toronto.

Trade Conditions in Italy

The May "Bulletin of the British Chamber of Commerce for Italy" contains a precis of articles which have appeared in the Italian press on the subject of United Kingdom trade with Italy. It is stated that the Italian market offers an excellent opening for manufactured goods which only two countries are able to supply—the United Kingdom and Germany—and, in view of the obstacles in the latter's way, sales will be easier for the former. German penetration in Italy represented a masterpiece of ability and patience. German firms endeavored to adapt their goods to the needs of the market, and also their prices and terms; they used more especially the efficacious arm of cheapness, to which they united the not less efficacious one of easy methods of payment, not only for the articles of direct consumption, but also in the larger fields of instruments of production. Italian manufacturers desirous of widening out or perfecting their plant obtained not only unusual credit terms from German firms, but also practical assistance in the mounting and working of machinery.

In 1913 Germany was already reaping the fruits of her methods; in 1895 she held a modest position among the nations exporting to Italy; in 1913, one year before the war, she had attained absolute pre-eminence with total sales valued at 603,000,000 lire, leaving the United Kingdom behind with a total of only 591,000,000 lire. On the outbreak of war British merchants at once thought of capturing neutral markets, and amongst these the Italian market, where Germany's hold seemed to be relaxing. The incitement came at the right moment, but attempts on the part of British manufacturers and merchants have not, so far, been very successful, because they have not been able to get over their spirit of conservatism, which leads them to persist in commercial customs which are difficult to reconcile with the exigencies of the Italian market.

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The Licensing of Engineers

IN a letter published in this issue, Prof. C. R. Young, of the University of Toronto, calls attention to the growing importance of the question of licensing engineers. He refers to developments in the State of Illinois, where a law has been passed requiring structural engineers to obtain State licenses. It has been pointed out that the Structural Engineers License Law just enacted in Illinois is the first interference by State legislation with general engineering work. Hitherto an engineer hailing from Boston, Philadelphia, Chicago, or San Francisco has been free to carry on professional work anywhere in the States. Hereafter, on every structure erected in the State of Illinois important enough to require the services of a structural engineer in any capacity upon its design and construction, that engineer must have a State license.

As bearing upon Prof. Young's letter, it may be interesting to consider the Illinois situation briefly. At present it is not difficult to obtain a license in that State. Any resident of Illinois now practising structural engineering may be licensed without examination on payment of a fee of $50. Each applicant is required to show (a) that at the time of the taking effect of this Act he was actually engaged in the practice of structural engineering in this State, and did not apply for license under Section 5 of this Act, in which case he is entitled to examination without regard to the number of years he has practised, or, (b) that within ten years prior to his application he has practised structural engineering in some State or territory of the United States, or in some foreign country for not less than six years, during at least two full years of which he shall have been in responsible charge of work as the principal or assistant, or, (c) that within ten years he has pursued a course of study and training in the theory and practice of structural engineering for the period of not less than six years in the employ or under the supervision of one or more practising structural engineers, during at least two full years of which he has been in charge of work.

Applicants who have graduated from a college or school of engineering considered by the board to be in good standing, requiring a course of study not less than four years, during at least thirty weeks in each year, shall be credited to two years upon the six-year period required above. If the result of the examination be satisfactory to a majority of the board under its rules, the secretary shall, upon payment by the applicant of $30, issue a license to practise structural engineering in this State.

Engineers not residents of Illinois who wish to practice structural engineering within that State must apparently be prepared to take an examination before the board, no matter how extensive their experience, according to the wording of the law.

There is indeed a clause permitting the State Board of Examiners in its discretion to issue an Illinois license without examination to structural engineers who are licensed under the laws of any other State or territory, or of any foreign country, providing such engineers have received licenses in their home State under a law as stringent as the Illinois law. As there are no States which have such laws, this clause is of no present importance.

Under this law, railway companies which have bridges or stations to construct or repair in Illinois must have the engineering work done by an engineer licensed under the State law. If the company's own bridge engineer resides in some other State, he will have to go to Illinois and take an examination or relinquish responsibility for the work to someone else. A manufacturing corporation may have plants in several different States and be accustomed to carry on repairs and enlargements from its general offices. If it wants to do any work on a plant located in Illinois, however, the engineer at the head office will need an Illinois license or will have to engage some engineer resident in Illinois to do the work.

It is possible that restrictive measures of this kind make for the more general requirement of engineering skill in structural design, but, as Professor Young points out, they do not constitute a guarantee that only first-class engineers practise the profession. Moreover, as will easily be seen by the Illinois measuse, in adopting this method of promoting the idea of greater skill in engineering the profession receives a set-back in many other ways. It would be most unfortunate if everyone dabbling in engineering work at a time such a measure were passed in Ontario received the hall-mark of a license without even the unsatisfactory test of an examination to support his claims.

We cannot think that the interests of either the engineering profession or the public will be promoted by establishing provincial boundaries for professional practice.

Why They Lost

IT appears that contractors still have something to learn about contracts and specifications. Three separate examples, representing different phases of this ignorance or disregard have come to our attention recently. In the first case a contractor, bidding on the construction of a supply house for a western city, would have secured the contract, but for two omissions. His bid was the lowest, but it came in after the time specified in the advertisement and was opened only through the courtesy of the other bidders. It was then found that no certified check was enclosed as required and the contract was awarded to the next lowest bidder. It is only too easy to find other examples of this sort. A little care in reading the advertisement and in complying with its requirements to the letter would have secured this contract.

In the second case, the contract for a sewer job was awarded to a certain contractor. It was later discovered that the time limit had been changed in this contract from sixty days, as provided in the specifications, to ninety days. After a warm discussion, the Board of Public Works rescinded the contract and decided to readvertise for bids. The contractor explained his action by saying that it would have been impossible to complete the work in sixty days. He was answered by the statement that the board had never taken advantage of the time clause where it was seen that the contractor was doing the fair thing and trying to complete his job. In this case the contractor trifled with the specifications and will suffer in consequence. He not only loses his contract, but has already ordered his material and had some of it on the ground.

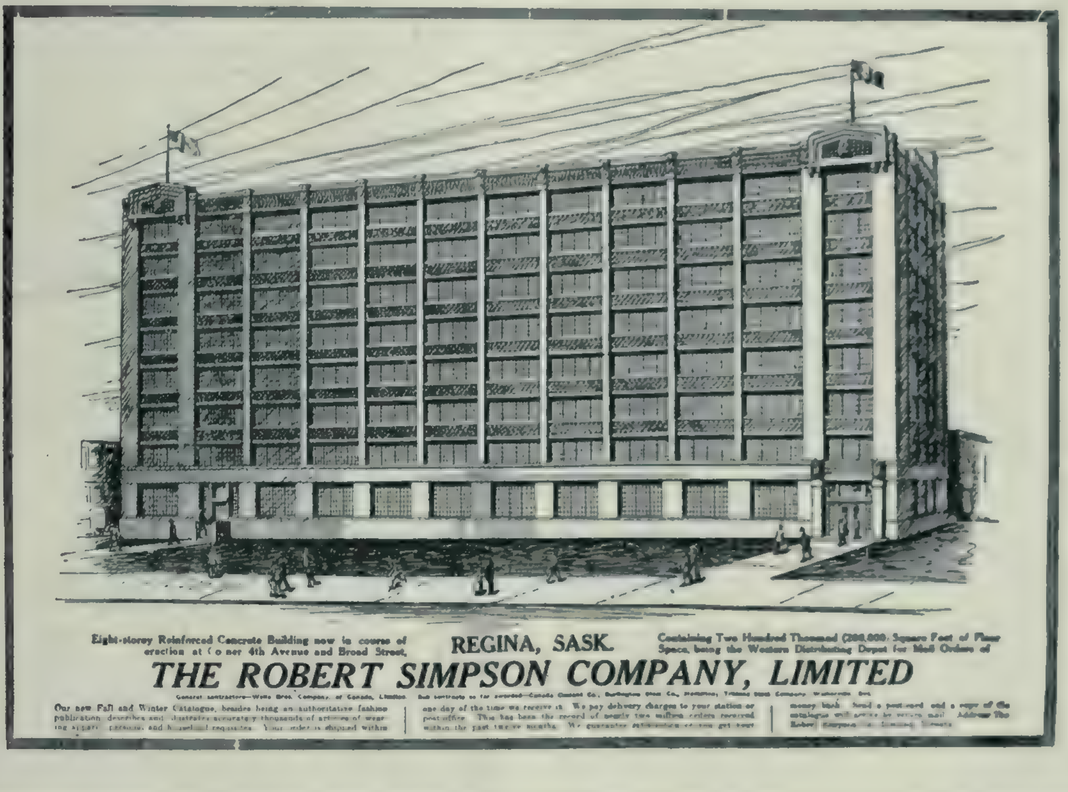
The third case is one of disregard of the specifications in doing the work. A Detroit contractor, in building a brick chimney for a high school building, used standard instead of the radius brick which the specifications required. A movement is on foot to require him to tear the stack down and rebuild it according to specifications. This contractor will probably lose not only the entire cost of the first job, but the cost of razing the chimney as well.

These three cases represent very different conditions. The first is pure carelessness, which can injure only the contractor himself. The other two carry some taint of "sharp practice." If contractors will learn to be careful in preparing their bids to secure contracts and in following specifications after they have secured them, they will have fewer causes for vain regrets and lost labor.

The Unemployment Problem

THE story which became current a few weeks ago to the effect that the Union of Canadian Municipalities was about to demand from the Ottawa Government the power for municipalities to make loans to industries which have been refused accommodation by the banks appears to be distinctly apocryphal, observes The Financial Times editorially. Perhaps it should never have received as much attention as it did, seeing that no such power could possibly be granted by the Dominion Government whether it wanted to or not; but there are plenty of municipalities which are quite equal to applying not only for what is not good for them, but also for what cannot constitutionally be granted them, so that the tale did not appear as unreasonable as it might have done. All that was really done in this particular direction (that is to say, in regard to the financial assisting of industries), was the adoption of a resolution asking "that the Dominion Government be respectfully requested to take such further means as may be within their power to obtain for Canadian manufacturers the manufacturing of war material and equipment for the Allied troops, and to make arrangements at as early a date as possible." This very moderate and universally acceptable program is all that the Union would commit itself to after a lively harangue by Mayor Stevenson of London, Ont., to the effect that an immense order for rifles had been refused by manufacturers in his city because of lack of the necessary machinery, and that the Government should have allowed this machinery to enter the country free of duty and even have purchased the machinery with public money and loaned it to the London manufacturers at a price.

The general belief among business men, a belief which is fully supported by observation of conditions in Montreal and other large cities, is that unemployment is not nearly as serious as some interested parties would have it supposed, and that it consists very largely of the noisy and obnoxious unemployable. It is a universal experience of social workers and economic students that following upon a period of real unemployment and hardship, the sufferings resulting from which are largely unobserved because the public attention has not been attracted to the subject and the victims do not themselves realize that they are suffering from a general economic condition, there comes a time when the I-Won't-Work comes out of his lair and boldly demands of the charitable societies, of the police and of the pedestrian in the street that he be supported by donations. By the time this occurs the real victim of unemployment, who has been conducting a genuine search for jobs in the meanwhile, has usually gone back to work.



Eight-storey Reinforced Concrete Building now in course of erection at Corner 4th Avenue and Broad Street,

REGINA, SASK.

Containing Two Hundred Thousand (200,000) Square Feet of Floor Space, being the Western Distributing Depot for Mail Orders of

THE ROBERT SIMPSON COMPANY, LIMITED

General contractors—Wells Bros. Company of Canada, Limited.

The Robert Simpson Company's Reply

When we penned the editorial article "Patriotism in Awarding Contracts" (Contract Record, August 25) protesting against the action of The Robert Simpson Company in awarding a contract for a half-million dollar building in Regina to a Chicago firm we thought it only fair to give the other side a fair field, and so we sent the Simpson Company the following letter:—

Dear Sirs,

We have received from a number of prominent Canadian contractors letters in which strong exception is taken to your award of the contract for your Regina building to a Chicago firm. It is freely stated that your company made no effort to give proper publicity to the work in Canada or to secure bids from the leading building concerns in this country. On the face of it this is a strangely inconsistent action on the part of a departmental store, which should be the first to recognize its duty to Canadians at a time when business and employment are at such a premium.

We propose to publish the letters in an early issue, but we feel that it is only right to give you an opportunity of explaining the situation if you care to do so. Without such explanation grave misunderstandings are likely to arise, and we can assure you that we have no desire to foster these.

It may be well for us to direct your attention to an editorial article published in our issue of August 25, in which we took strong exception to the action of your company. For your convenience we enclose a proof of the article.

Yours truly.

No communication having been received by us from the Simpson Company, it is fair to assume that their reply is contained in the half-page advertisement published in the Toronto Mail and Empire of September 11, and reproduced above. In the ordinary way the advertisement would call for little comment, but it is not customary for departmental stores to advertise their contractors immediately beneath their own name. Neither is it customary for Chicago firms to pick up contracts of this magnitude one day and adopt the style of a Canadian firm the next . . . But, in any event—think of it, O ye gods!—"The Wells Brothers Company of Canada, Limited!" It is enough to make many of our contracting friends who have gone to their rest of late years turn in their graves. "Of Canada, Limited!" What smug devices are afforded for pulling the wool over the eyes of the man in the street!

In the paragraph at the bottom of the advertisement The Robert Simpson Company stand for the following trite sentence:—"We guarantee satisfaction, or you get your money back." Not all of it, surely! Some of it must go to that well-known Chicago firm, Wells Brothers Company of Canada, Limited.

Tests of California glazed cement pipe now used in the construction of the Long Beach sewer system have just been made and show excellent results. Broken pieces of 30-in. cement sewer pipe, immersed in water for a period of 24 hours were found at the end of that time to have absorbed of moisture less than two per cent. of their weight.

Municipal Works—The Possibility of Their Economic Execution

By R. O. Wynne-Roberts, Consulting Engineer, Toronto.

IT is strange that when work in almost every line is plentiful, with prices of materials and labor at high-water mark, and contractors' profits on a generous scale, municipal authorities, as a rule, are infected with the contagious spirit of enterprise, and they also decide on schemes which are deemed necessary for their cities and add their quota to the prevailing abundance of work. The reason for this is generally the cheapness of money. Debentures are in demand at attractive figures. Aldermen are as human as the rest of mankind, so that when they see the credit of their city standing high in the estimation of the investors, and when money is obtained with considerable facility, they follow the natural tendency to "spend when you can." This, however, is not the best policy, for the ratepayers at these times pay for the work at top-notch prices, whereas if the work were carried out more steadily it would cost less and the men would be more regularly employed. Events of this kind are not uncommon or local, whilst the results are always the same.

It is most commendable that public spirit should be well established, that cities should carry out works which are necessary for the welfare of the people and add to the attractiveness of the place from a residential and commercial point of view. Cities must progress: there is no time in their history when stagnation is good. Ordinary business may be brisk or slack, but city work, like the babbling brook, should go on steadily for ever. That is one fundamental method of securing economy and efficiency, or more correctly expressed, efficient economy.

When ordinary business is poor and profits are near the vanishing point, public spirit tends to be less pronounced. If the business men are not turning over the same amount of money as in good times they naturally reduce the expense if possible. In city affairs this should hardly be necessary, because there should not be undue expansion of city work in excellent times to warrant an appreciable reduction in poor times. But the usual attitude is to cut out new works—when they would be so helpful in many ways. Debentures may not be so saleable in slack times, and the amounts offered for them may be thought too low, or the interest demanded may be considered too high.

We are now passing through a crisis such as has never before been experienced—and it is hoped will never be experienced again. It demands of the people strong nerves, stout hearts, abundant faith, and strenuous energy.

Canadian cities have felt the pinch of the depression, but when the conditions are compared with those in cities in other lands, even in neutral countries, it will be found that Canadian cities have not, as a rule, been as seriously affected by the war and the depression. Supposing, however, that condition had been even worse here than in other countries, it would still be incumbent on the city authoities to consider the unemployed, and the effect of unemployment on local business and the morale of the community.

The position is more satisfactory than it would appear to be at first sight. While the interest on debentures has gone up from one-half to one per cent., or say an average of three-quarters per cent., the prices of materials have dropped considerably. Sewer pipes in Toronto cost about 32 per cent. less in 1915 than in 1914; bricks have been reduced about 33 per cent.; masons' work costs about 26 per cent. less than in 1913; labor is cheaper and contractors figure much more closely. It is reasonable to anticipate that there will be more or less relative reductions elsewhere. Where materials have to be hauled a long distance by rail, the reduction may not be so appreciable, because the cost of railway haulage will remain the same and oft-times such cost exceeds the price of the materials. Though there may be some things that cost the same or slightly more to-day, still, taking everything into consideration, it may be reckoned that the reduction in cost of labor and materials will be at least twenty per cent.

The question now is whether municipal authorities would suffer or gain financially if they carried out new works on a reasonable scale at the present time.

Supposing that a certain work would cost in ordinary times about $50,000; then if it is carried out now the cost would be about $40,000—there would be a saving of, say, 20 per cent. or $10,000 on the job. If the sum of $10,000 was invested at 5¾ per cent. compound interest for thirty years, by that time it would have increased to about $53,880. But the city would borrow only $40,000 and this at 5¾ per cent. would represent $2,300 per annum in interest. The interest in normal times was only 5 per cent., so that there would be an extra ¾ per cent. to pay now or $300 per annum. The value of this annual sum compounded at 5¾ per cent. for thirty years would be about $24,300. In thirty years, therefore, the city would lose about $24,300 in capitalized interest and gain $53,880 in the capitalized saving, a difference of about $30,000 to the good of the ratepayers.

This transaction can be expressed in another way. The saving on the job would be $10,000, but the city would have to pay $300 extra interest each year for thirty years. The debenture buyer would no doubt be willing to accept payment of this debt now and thus relieve the city of further liabilities. This equity would be worth about $4,200; so by commuting the liability in this way the city would pay $4,200 to save $10,000. This is a practical economy, as it represents over 14 per cent., or $40,000. There is ample margin for deductions if the estimate is considered too sanguine.

By carrying out necessary works now the municipal authority would get them done at a lower price, they would probably be better done—as competition would be keener, workmen would be employed, charity organizations would have less to do, and good finance would have been studied. Money would be put into circulation when the tradesmen most needed it, the public would enjoy the advantages of the new work and the city would steadily progress instead of stagnating. "Keep moving—however slowly" is a good maxim for all.

It must not, of course, be thought that it would be possible to carry out work which can easily be postponed without detriment to the people, as it would manifestly be unwise to call for money for such work. But smaller works associated with the public are looked upon by investors as legitimate expenditures at the present time.

LETTERS

The Licensing of Engineers

To the Editor of The Contract Record and Engineering Review:

Sir:

Recent developments in some of the states of the American Union, notably the enactment of a license law for structural engineers in the State of Illinois, have brought the question of licensing engineers prominently to the fore. Since this activity is no doubt the forerunner of many attempts elsewhere to close the profession of engineering it is necessary that engineers should give earnest thought and study to the probable consequences of such legislation.

While restrictive measures undoubtedly debar many uneducated and unskilled persons from future recognition as practising engineers, they do not by any means ensure that only first-class engineers receive authority to practise. Ability to pass examinations is an unreliable indication of capacity as a practising engineer. When it is recognized, too, that the enactment of a restrictive law appears possible only by the granting of a license without examination to every engineer, capable or incapable, who is nominally in practice at the time, the difficulty of solving the professional problems by legislation is readily seen.

The writer is aware that a case can be made out for the licensing of engineers but believes that if the question were again raised in this province it would be received with no more favor than was shown it a dozen years ago. It would be interesting to know what opinions are now held by engineers in general respecting this matter.

Yours very truly,

C. R. YOUNG.

University of Toronto, Sept. 9th, 1915.

* * *

Patriotism in Awarding Contracts

Editor, The Contract Record:

The leader beneath this caption in your issue of August 25 is of interest to the building trade of Canada as a whole —to architects, engineers, contractors, building supply merchants and manufacturers alike, all of whom suffer through the action of corporations, municipal as well as private, when they employ United States rather than Canadian contractors. A few years ago it may have been more or less necessary to look abroad for men experienced in designing and executing large undertakings. That is the case no longer, however. And yet, from the frequency with which many individuals, as well as banks, municipalities, and other corporations, prove their want of faith in Canadian ability, it is evident that means must be adopted to compel the attention of these "little Canadians" to the altered conditions. As the only approach to their sensibilities lies through their pockets, it must be made clear to them that it is directly to their advantage to deal with that public from which their dividends are drawn.

During such a period of stress as the present the wisdom of conserving the interests of that portion of the Empire in which our lot is cast would seem to be too obvious to require explanation or emphasis. It is, indeed, positively indecent deliberately to increase the difficulties of existence for one's own countrymen in such a crisis; and yet the action so vigorously denounced by you is of common occurrence.

One phase of this practice of placing business in the hands of aliens was discussed recently by the members of the Architectural Institute of British Columbia. During the "piping times of peace," when all things flourish, many firms of American architects open offices in Canadian cities and canvass in a thoroughly systematic and businesslike (but not always entirely professional) manner for employment, which, when secured by them, almost invariably leads to the execution of the work being placed in the hands of alien contractors, who, as a matter of course, deal as far as may be possible with kindred manufacturers and building supply merchants. Much even of the labor employed is alien, including draughtsmen, superintendents, and foremen. Some of the materials are supplied, and a good deal of sub-contracting executed, by Canadians. The husk is awarded to us; but the kernel, including the profits and the professional fees, leaves the country. It is most noticeable, also, that when trade conditions become adverse and margins narrow these alien architects and contractors take wing and depart, like swallows before the chill of the approaching winter, taking with them everything except, possibly, sad memories.

There is a legendary customs duty to be levied upon imported plans. Can an instance of its enforcement be stated? The drawings, when prepared in Seattle, San Francisco, or Chicago, are represented only by blue prints in Winnipeg, Regina, or Vancouver, and H. M. Customs, in the plentitude of their wisdom, pass them or tax them upon their declared values as duplicates, instead of upon their real value, which is represented by from three to three and a half per cent. upon so many thousands or hundreds of thousands of dollars. But, then, H. M. Customs Department is not infrequently, like the majestic law of the land, an unmitigated "hass." So the country does not benefit even to the extent of ten per cent. upon that portion of the architect's commission which represents the absolute value of the working drawings—their cost, in short, to the owner.

No doubt the same condition prevails in the engineering world. When the engineer is American, the contractors, materials, profits, etc., are all American as a natural sequence —merely duplicating the case in which an American architect is given a similar preference.

Although Protection is our national policy, it leaves the members of two professions and the whole of the building trade wide open to American exploitation. The duty on plans is manifestly "fudged;" neither the alien architect nor the alien engineer has to obtain a license, or is even required to be a recognized practitioner in his own country; and no bond or security is required of the alien contractor other than that arranged in his contract with his alien-loving employer. Could anything be more absurdly unfair to the Canadian?

No Canadian—or, for that matter, any alien—architect can practise in the United States until he has been admitted to the State Institute of Architects or its equivalent—a wise provision to which no objection can be raised. No foreign architect can hope to secure any description of public employment until he becomes a naturalized citizen of the United States, and I think I am correct in stating that no foreign contractor can hope to secure a municipal or State contract. This is surely as it should be—American money for the American worker. The fact that the Canadian worker lacks this protection is frequently the subject of bitter comment.

Why should not those connected with the building trade organize and unite to compel the Canadian Government to pay attention to their demands for an equal degree of the protection afforded to other interests? Nothing can be gained without fighting; and the power to move politicians is the vote. A conference of delegates from incorporated bodies of architects, engineers, contractors, and material merchants throughout the country should be able to do something towards obtaining remedial legislation. The interests represented would be very great—possibly greater than any other one industrial interest in the country—and sufficiently powerful to command the respect of our professional politicians and patriots, who are ever ready to head the crowd when it has indicated unmistakably the direction in which it intends to be led.

Yours truly,

R. MACKAY FRIPP.*

Vancouver, B. C., Sept. 15, 1915.

* * *

Vancouver Contractor's Denunciation of Contract Procedure

Editor, The Contract Record:

Patriotism is a splendid thing, but in normal times few people will pay anything extra for it. If we could only satisfy ourselves with as good work and material from our own people at the same price as we take it from foreigners, and carry out this idea in all our buildings, we should confer a benefit upon ourselves and our country.

During the boom days of Vancouver and the Western cities, when the principal industry was building, many outsiders flocked in and secured a large portion, if not the best, of the business. A few of these new-comers—most of them from the other side of the line—are with us yet, and some of them are amongst our best citizens. Without a doubt the United States people make splendid Canadians, and we are pleased indeed to have them come and stay. The majority, however, having no stake here, have pulled out, taking away large profits—and in some cases far more than their profits.

We were careless then. How much better it would have been if we had discriminated a little and put the business more into the hands of responsible Canadian citizens. It would have cost us no more—in many cases less—and the work would have been done better. The local men, knowing the best materials and methods for our peculiar conditions, and having a reputation to sustain, are always available to consult with and make good any of the little defects that may arise. They can point with pride to their work, and—what is most important of all—the profits and the wages, and the money for the material, are still here. In Vancouver one can point to buildings built by conservative business men who employed irresponsible outside architects and contractors, and the work is now giving a great deal of trouble. No thought was given to our damp climate, which makes it necessary to cover and protect all masonry. Imported materials were used unnecessarily, thus making it hard to effect changes or make repairs. Many basements were not adequately drained, causing trouble hard to overcome. Even the C. P. R. in their new depot allowed their architects to specify an imported stone—although in fairness to the company it must be said that when this matter was brought to their attention they would have changed the stone for local material (which has no peer) had there been time. On some of our public buildings money was practically thrown away, costly changes having had to be made within two years after completion. In other cases, such as our city gaol, which cost nearly $300,000, radical changes had to be made after completion to make the building fit for the purpose intended. Some important buildings were erected by large United States contracting firms, who talked the owners into construction, supplying the plans and specifications, and doing the work on a percentage basis at a guaranteed cost—but they have gone now. In one fine building the tiled lavatory floors have all burst up, breaking many valuable plumbing fixtures. This was caused by the filling-in around the pipes (composed of the plaster rakings from the building) having expanded. Another fine hotel has had a false floor and side walls put in the basement so as to get out of the water, the drains having been left out.

Many public and private buildings erected during our progressive times would have been more serviceable and in better condition to-day had our business men—interested both privately and as public officials—realized that money will not always come so easily. If they had not been in such a hurry, and had given more time and consideration to the requirements of the city, and had submitted their propositions to old and tried architects and contractors, they would be wearing a more satisfied smile to-day.

As a practical builder I cannot express too strongly my disapproval of the common system followed by the public bodies as far as ordinary building procedure is concerned—first, in calling for competitive plans, and secondly in not having these plans properly judged by practical men. Under the competitive plan system a young and new draughtsman, having nothing else to do, prepares a pretty picture at the expenditure of much time and care, but perhaps with absolutely no knowledge of construction and the accepted rules for a locality, while the experienced, busy architect puts in a plain straightforward drawing or nothing at all. The typical public man really has no practical knowledge in this line, and yet he takes it upon himself—leaning on some weak reed for advice, perhaps—to decide such important questions.

Yours truly,

E. G. BAYNES.†

Vancouver, B.C., Sept. 8, 1915.

* * *

"Yankee" on Patriotism

Editor, The Contract Record:

The articles published in your issue of September 8th relating to "Patriotism in Awarding Contracts" make me laugh. You are throwing it into The Robert Simpson Company—and rightly; but how about The T. Eaton Company, who are just putting up a building in Hamilton with United States architects and United States contractors?

These two departmental stores are yelling their heads off telling people to buy in Canada and keep their money in Canada. Rot! They mean, keep it in their own coffers.

Note the contrast: when American firms start over here they invariably try to place everything possible with Canadian firms and help people here and the country generally—that is why they prosper.

The patriotism of most Canadians is measured by their selfish personal view of the dollar. Any number of cases will bear me out in this, despite a lot of recent slurs on Americans as "dollar-hunters." Of course they are dollar-hunters, but back of their business enterprise is the sentiment "our country first."

Canada needs a lot of schooling in proper patriotism. Go into any store and ask for the best thing they've got in a stove, and you will find that it comes from Detroit or Chicago—while there are lots of good-looking stoves made in Canada right beside them, and signs on the wall "Buy Goods Made in Canada." Try furniture and other articles, and the same thing occurs.

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* President, Architectural Institute of B. C. (Inc.)

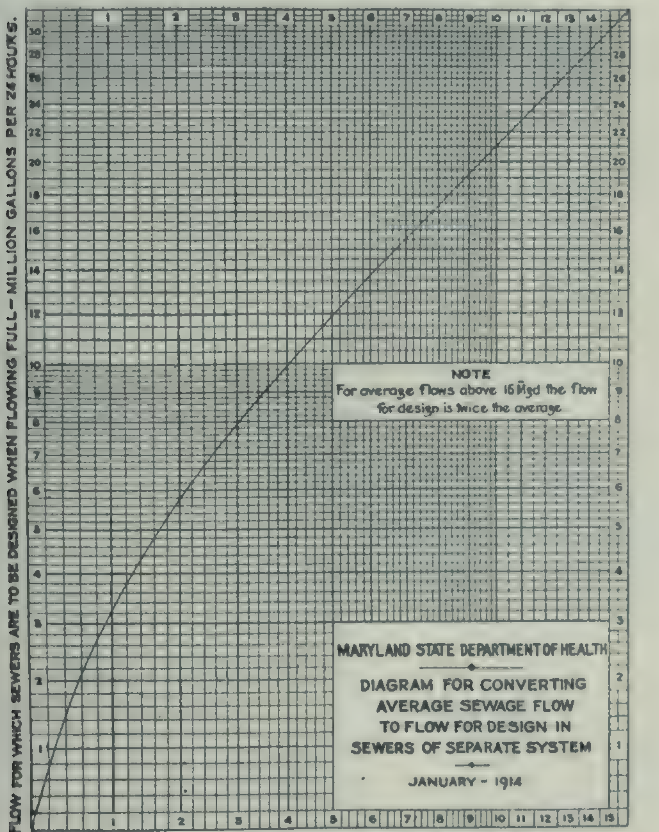
† Of Baynes & Horie, contractors, Vancouver, B. C.

Canada has a great deal to learn about manufacturing, selling, and patriotism.

Yours truly,
Yankee.

Method of Estimating Capacity of Sewers

An interesting point described in a report on the collection and disposal of sewage in the District of Columbia, submitted recently to the Maryland legislature, was the method of estimating the capacity of the sewers in the several main drainage systems. A separate system of sewers was to be used throughout and the flow assumed in designing the house sewers was based on 80 gallons per capita of tributary population, plus ground water leakage of 10,000 gallons per day per mile of sewer. The flows which the trunk sewers were designed to carry when running full were taken from the diagram shown herewith, which gives the amount of sewage which it is deemed necessary to provide as the capacity of any sewers of the separate system when flowing full, based upon the average daily flow. For instance, if the average daily flow reaching a certain sewer is estimated to be three million gallons per day, we find from the diagram that the sewer should be designed to carry a maximum of eight million gallons per day when flowing full. If, however, the estimated average flow is fifteen million gallons, the sewer would be designed for a capacity of thirty million. The ratio between estimated average flow and the quantity used in calculating the size is a factor designed to cover variations between maximum flow and average flow and also to allow for miscalculations in estimating average flow; both of which would ordinarily be less the larger the sewer; or, what would generally be the same thing, the larger the area it drained and the greater the number of tributary sewers which it received. "The idea of designing sewers from a rational curve of this sort was, so far as the writer (Robert B. Morse) is aware, suggested by Ezra B. Whitman, former division engineer of the Sewerage Commission of Baltimore City. The curve drafted by him was based upon actual measurements of sewage flow in various cases. . . . . The curve was revised by the writer, used on the Baltimore sewerage work, and was afterwards suggested by him for use on the work of the Metropolitan Sewerage Commission of New York. The curve on diagram 3 (that shown herewith) is the one finally adopted by the Metropolitan Sewerage Commission, and was drawn up by John H. Gregory, then engineer of that commission. It was adapted from the curve used at Baltimore by multiplying the average sewage flow by the corresponding factor, so that when the average flow was known, that for which the sewer should be designed when full would be apparent at once."



Design for calculating capacity in designing sewers.

Architects and Modern Construction

THERE are many architects who look upon modern construction as coming more within the scope of the civil engineer than within their own sphere, says a writer in The London Builder, and in consequence they neglect to study seriously this important branch of architecture. All classes of construction should undoubtedly come within the architect's curriculum, because it is only by having a thorough knowledge of this subject that he can design efficiently and economically, and thus do his duty to his clients. Generally speaking, the subject is studied casually, and the simple forms only are mastered, such as will obtain in ordinary domestic buildings, but when the question of scientific construction in large buildings of a modern type or investigation of the properties of materials comes into view, then the architect is inclined to feel that he can proceed no farther unless he intends to specialize in this particular subject. It is a well-known fact that the scope of an architect's training is a very large one, and many years of very hard study and practical experience are necessary to equip him sufficiently for his duties; but it is also obvious that the study of construction is seldom treated with sufficient importance by the average architect. Upon reading the results of the Intermediate and Final Examinations held by the Royal Institute of British Architects it will invariably be found that the percentage of failures in constructional subjects is greater than that in any other, and this indicates either lack of interest or insufficient study, or probably both, the student in many cases hoping that he will be able to "scrape" through his examination and put certain letters after his name. He does not appreciate the fact that the proper study and interest of construction will be of great assistance to him in later years, and it is included in his Examination syllabus for this reason.

Generally speaking, it is architectural design which possesses the greatest fascination for architects, and they desire to see their taste and ideas embodied in the treatment of a building; but, having prepared a drawing on paper expressing their ideas, they are often quite content to leave the actual responsibility for the realization in other hands. It is, however, impossible to dissociate design and construction in this manner, as all successful design must necessarily take into account the nature and limitations of the various materials to be used; and it will always be found that any work which does not satisfy the spectator as being constructionally sound is equally unsatisfactory as regards artistic design.

There are a certain number of persons who are born designers, and they have a special genius for producing designs which are of the highest merit, while it is impossible for them to carry them out without assistance as to construction; but, generally speaking, a good knowledge of construction can be acquired by anyone if sufficient time is devoted to theoretical and practical study. In design, the question of individual taste will always be an important factor, and what is pleasing to one designer will possibly be rejected by another; whereas in construction the student has to deal with actual facts of strength, lasting qualities, and economy; and the principles of good construction of all kinds should be thoroughly mastered before any attempt at designing is made. The architect should also keep up with the times and study modern methods of construction, as it is only in this way that new types can be applied to produce true architectural effect, no designer who is without knowledge and sympathy with the material being able to evolve the best work.

Architects must realize that the client is interested in the actual structure as executed, and, although the architectural effect produced will be an important factor, the sound construction and lasting qualities will be the primary consideration to him, and, from a business point of view, it is necessary that the client should be satisfied and pleased not only at the time of completion, but also after several years have passed. The architect is responsible for the adoption of the various materials used, and also for the manner in which the work is executed, and unless he possesses a good knowledge of building construction he cannot fulfil his functions in a proper manner. The architect is retained by the client, not only to prepare designs, but also to see that the work is carried out in a satisfactory way, and it behoves every architect to direct and supervise the building under his charge in such a manner that the client gets sound construction, and in many cases the necessary knowledge and training are lacking. In the case of large buildings, where the construction is of a complicated nature and a tremendous amount of work is involved in the calculations and preparation of the necessary drawings, it is quite natural and proper that a consulting engineer is employed to work in conjunction with the architect; but the latter should, at the same time, possess sufficient knowledge to be able to discuss the various problems intelligently, and he should retain his position as the chief agent of the client and be responsible for the actual structure. There is a great tendency, however, to shirk this responsibility, and even in small buildings it is a general thing for architects to give the calculations and preparation of the steel and other constructional drawings into the hands of firms whose interest is to make a profit on the work.

How many architects are able to design the constructional steelwork for their own buildings? Very few indeed, and the consequence is that they are absolutely in the hands of the merchants who supply the material, and this despite the fact that the architect is the responsible person, and no guarantee given by the person supplying the material can release him from that responsibility. Steelwork construction should be studied by the architect, and he should be competent to design and check same, as it enters largely into modern construction, and it is his duty to give size and details of all parts of a structure for which he is paid to design and supervise. Failing the employment of a competent independent engineer to do the work for him, he is likely to get too much or too little steel in the building, for which his client pays, in accordance with his methods of obtaining schemes from merchants without or with competition. What applies to steelwork applies also to other constructional materials, and it is absolutely essential for a competent architect to be thoroughly trained in building construction.

The modern developments are all on the lines of more scientific methods, and perhaps the most striking example of this is provided in the extensive use of reinforced concrete during recent years; and yet there are very few architects who have attempted to take up the proper study of this material in order that they may be able to check the specialist working under him, or design typical portions of a structure for his own guidance when preparing the general architectural drawings. This state of affairs is to be regretted, and it is this attitude of the architect to the many branches of his profession, apart from the purely artistic side, that has earned for him the reputation of being generally a poor man of business. The average client appears to be imbued with this idea also, and in many cases looks upon an architect's fees as excessive; whereas, if the work of designing, detailing, and supervising is properly carried out, an architect thoroughly earns his money. When this disastrous war is over there will be much work for architects on the Continent and elsewhere; but a knowledge of building construction and business ability generally will have a tremendous effect on the success or otherwise of those in this country who obtain a share in the work, and it is to be hoped that endeavors will be made by architects to prove their worth as business men, and this can only be done when the realization comes that the actual construction of all classes of building work is a question which comes within their sphere, and must therefore be seriously taken up by them and not relegated to other persons.

There is perhaps a greater difference in opinion as to proportions for mixing concrete than in any other phase of concrete construction. What is more, opinions and formulas are changing all the time. For example, only a few months ago the cement world was startled by an engineer who applied microscopic tests to concrete—something which had never been done before. He found that even in the best kind of concrete work much of the cement was inert; that is, it had not been hydrated, it was not acting as "mineral glue." Not so many years ago every one thought that sand and aggregate with sharp corners were the most desirable. Rounded pebbles were taboo. Lately it has been shown by prominent engineers that rounded pebbles can also be used without detriment to the concrete.

The fire losses in the United States and Canada for the first half of 1915 as compiled by the Journal of Commerce reached a total of $93,391,000, against $133,018,250 in the first six months of last year. July, according to the same authority, showed fire losses of $9,006,800, as compared with $17,539,800 in July, 1914.

The Design and Construction of a Unit-Cast Mill Building at Victoria, B. C.

THE following data refer to the design and construction of a reinforced concrete building of the saw-tooth type built for the Vancouver Portland Cement Company, of Victoria, B. C. The structure, which is of "unit" construction, consists of 18 bays, each bay being 18 ft. x 18 ft. 9 ins. x 27 ft. 3 ins. high from floor to top of columns. The unit type of construction was adopted on account of the duplication of bents, the height of the columns, and the necessity of keeping two rotary coolers in continuous operation during the construction of the building. The locations of these coolers are shown in Fig. 1, which is a sectional elevation of the structure. This drawing also shows the special constructions required at the locations of these coolers. The coolers are used for handling clinker from the rotary kilns at a temperature of about 1,500 deg. F., the heat from which was too great to permit the use of timber forms near them. In addition, it was necessary to keep clear a railway track which occupies the space between the two coolers.

Casting Floor and Handling Equipment

It was decided to cast the various units on a casting floor located outside of the building. This floor, which was about 30 ft. wide by 100 ft. long, was built of 2-in. tongue-and-groove dressed lumber. The floor was carefully leveled, and a special type of "telpher" track was built on each side of it for use in handling the long girders and columns (see Fig. 3). This track consisted of a 20-lb. rail spiked to timber stringers, the latter being supported by timber posts spaced 18 ft. on centres. A two-wheeled carriage, having grooved wheels overhung on a ball-bearing shaft, operated over the track. To this carriage there was attached a frame carrying a five-ton chain block. A 29-ft. length of 7⅛-in. H-section beam was used as a sling to support the concrete columns and girders and to provide means of attaching the chain block at each end. By lifting the units high enough to clear the other forms, using steel bars which were inserted in holes cored in the concrete members, the units were easily transferred to the storage yard. When the members were required the same methods were used to place them on a flat car which operated over a track, the latter crossing under the telpher track.

A ½-cu. yd. motor-driven "Ransome" mixer was located at one end of the casting floor, the mixer having been set high enough to discharge into concrete buggies which were operated over a runway laid on top of the unit forms.

Girders, Columns and Forms

The girders are 12 x 21 ins. x 18 ft. 5 ins. long, each girder being reinforced with three ¾-in. bent bars, two ¾-in. straight bars, and with ⅜-in. stirrups. The

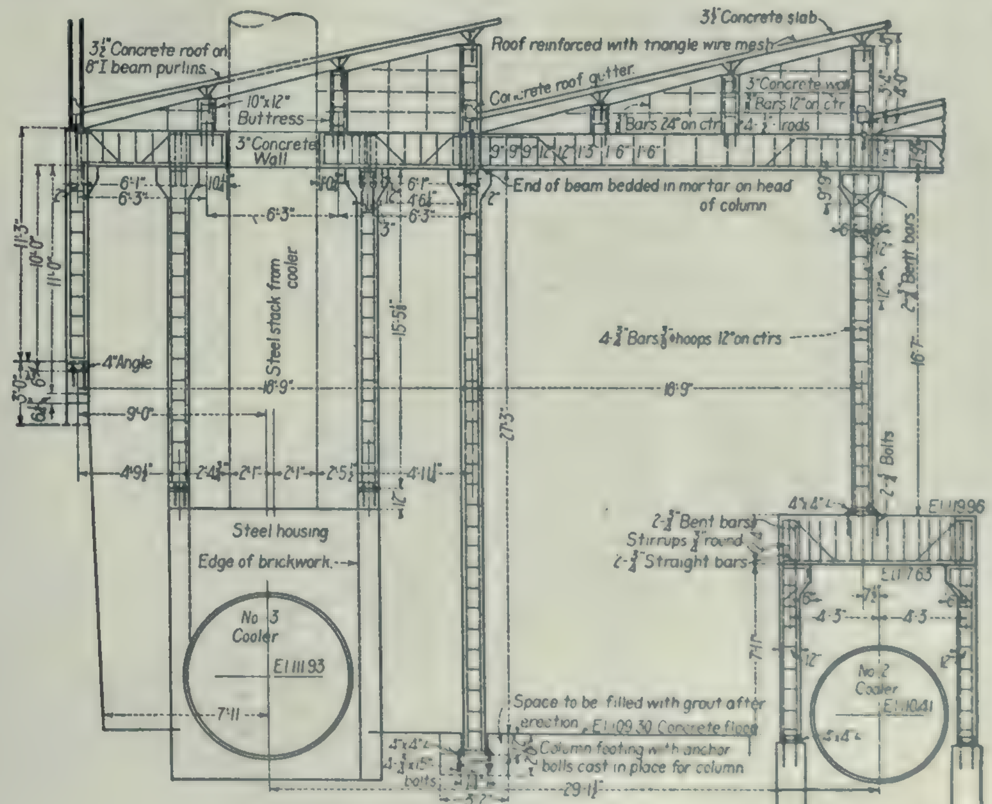


Fig. 1.—Sectional elevation of mill building at Victoria, B. C., showing types of construction and special features at coolers.

columns are 12 ins. square and 28 ft. 3 ins. long, with an enlarged head to provide additional support to the girders. The ends of the reinforcing bars project 18 ins. beyond the head of each column, while the ends of the bars in the girders project 2 ins. at each end. Fig. 2 gives details of the colnmns and girders. As will be noted by referring to these drawings, 1-in. holes were cored in the columns and girders for lifting purposes, while in the columns two ¾-in. bolts, threaded at both ends, were cast into the columns to provide means for attaching the 4 x 4-in. anchorage angles. The reinforcing steel for each member was made up, tied and placed as a unit. The forms were made readily collapsible, and were held in place by ½-in. x 3-in. iron flats, which engaged in holes in the floor, as shown in Fig. 2. This arrangement enabled the forms to be held in alignment and thus insured straight columns.

A 1:2:3 concrete mixture was used for the columns and girders. By casting the units in a horizontal position, careful tamping of the concrete was assured, and the finished units were found to be comparatively free from defects. The concrete was allowed to set for seven days, on the average, and the unit was then moved to the storage yard, where it remained until it was erected.

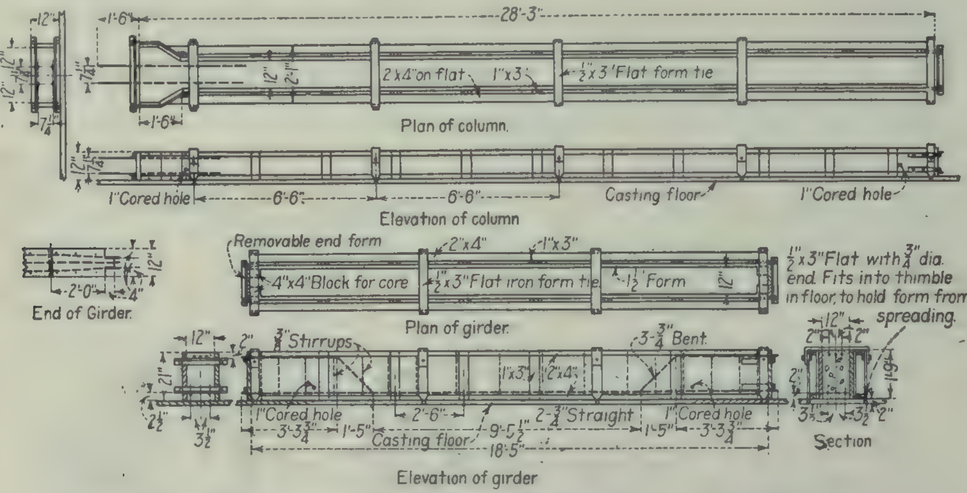


Fig. 2.—Plans and elevations of typical girders and columns of mill building at Victoria, B. C.

After the excavations were made for the column footings the concrete was poured up to a plane 1 ft. below grade. Four ¾-in. anchor bolts were then set for each column. The columns were then erected by means of a gin-pole hand winch, as the site was too congested to permit the use of a derrick. The gin-pole was also used to pick up the girder at its center and to set it on the tops of the columns. Before landing the girder in position a thin layer of mortar was spread over the head of the column to insure a uniform bearing, and a form was then placed around the joint enclosing the projecting column and girder reinforcement. The dove-tailed ends of the girders were then grouted with a wet 1:3 mortar.

After the girder had been set in place a collapsible form was set on top of it, and the roof supports were poured in place. Fig. 1 shows details of these supports, which consist of three 10 x 12-in. buttresses connected by a 3-in. reinforced concrete wall. Anchor bolts were set in the buttresses for attaching the 8-in. I-beam purlins which support the roof slab. The buttresses are bonded to the girder with ¾-in. dowels, which were grouted into holes cored in the girder.

The forms for the roof slab were made in sections and were supported on the bottom flanges of the I-beams. As shown in Fig. 1, the upper flange and the web of the I-beam were encased in concrete, only the bottom flange being left exposed. The concrete for the roof slab was mixed at the central plant located on the casting floor. The 1-cu. yd. "Koffel" side-dump cars were hauled by an electric winch to a tower located at the edge of the building. A second winch picked up bodily both the car and a section of the track, and lifted them about 35 ft. to the level of a track on the roof, where the concrete was dumped into a box and distributed by wheel-barrows (see Fig. 4).

The roof slab, which is 3½ ins. thick, was finished with a ½-in. layer of 1:2 mortar, troweled smooth. A concrete gutter was molded in place to provide adequate drainage.

The girder and column forms were used repeatedly, as were also the buttress and the collapsible roof-slab forms. Excellent results were obtained in this building by the use of unit construction, and it was estimated by the engineer in charge that the cost of the structure was only 70 per cent. of that of a similar design built in place.

The structure was designed and erected under the direction of Mr. D. C. Findlay, C. E., for the Vancouver Portland Cement Company, of Victoria, B. C. We are indebted to Engineering and Contracting for our information.

The finish of forms for exposed concrete depends upon the degree of finish called for in the specifications. If the concrete is to show a smooth surface, the surface of the form in contact with it should be smooth. Joints should be made perfectly flush after they are built in place by planing off any unevenness or projections that occur or any openings at joints or corners. Knot-holes or other voids should be plugged flush with some stiff, plastic substance, such as fire clay mixed with plaster of paris, or sand.

In the early stages of reinforced concrete construction, it was but natural that it required more time to erect buildings of this kind. They were new. But with the specialization of architects, engineers and contractors on reinforced concrete, it has now come to be the most rapidly built of all forms of non-burning construction.

Surface Finishing for Concrete

IN our issues of September 1 and September 8 we gave considerable data on the cost, appearance, and wearing qualities of various methods of surface finish for concrete as compiled by the Committee on Masonry of the American Railway Engineering Association. The replies were based on the following requests:—

(1) What methods of finishing surfaces of concrete work have you used? Give specifications of each method used.

(2) State object desired in finishing and results obtained as to appearance and wearing qualities.

(3) State the cost of the work per square foot (labor and material) for each method.

(4) Please state your opinion as to the best manner of finishing a concrete structure. Do you believe the concrete surface should be left untreated, or should it be tooled, scraped, or treated with an acid?

(5) Is it your experience that where the natural surface of concrete is treated it is more susceptible to discolorations from smoke and the weather?

(6) Remarks.

The following additional reply was contributed by F. L. Stuart, Chief Engineer of the B. & O. System:—

(1) Two methods: One, rub surface upon removal of forms; second, bush-hammer the entire surface.

Under method No. 1, where forms can be promptly removed, excellent finish may be had by rubbing the fresh concrete with a wooden block, using enough water to keep the surface saturated while rubbing is being done. When surface has become hard, after general irregularities have been removed with chisel or bush-hammer, entire surface may be rubbed with cement or carborundum bricks, the surface being kept thoroughly saturated with water. To insure uniformity of color, grout wash may be applied while the rubbing is being done.

Under method No. 2, the entire surface may be dressed with bush-hammers, operated by hand or by air, all form marks and other irregularities being removed, except the construction joints. This method is not desirable, however, unless the concrete is very dense and excellent quality, for the reason that exposure will result in final damage to the surface.

(2) The purpose of treating the surface of concrete is to improve the appearance of the work. The wearing qualities will not be affected favorably or adversely by being finished according to method No. 1. The surface may be seriously affected where method No. 2 is resorted to, especially if the quality of the concrete is not first class. Concrete which has been dressed or bush-hammered is less impervious to moisture, which in freezing weather will cause the surface to scale.

(3) The cost of finishing the surface by method No. 1 depends largely on the care exercised in casting. If the surface is reasonably smooth and the rubbing is done promptly before it becomes hard, the cost should not exceed 1c. per square foot. The cost of bush-hammering will vary from 3 to 3½c., depending on how the same is done.

(4) In our opinion, the surface of a concrete structure, where the forms have been properly constructed, should not be treated, except to remove the lipping caused by the joints in the forms. The natural surface with good forms, and when properly spaded, we believe will be more durable if left untreated.

(5) From recent examination of several large structures, where certain portions were treated and others left untreated and which have been exposed to the weather for periods ranging from four to eight years, it was found that the natural surface of the concrete is not as susceptible to discoloration from smoke and weather as surfaces that have been bush-hammered, the same being true in the case of discoloration due to seepage of water through construction joints of porous portions of the structure.

(6) In our judgment, the surface of poor concrete should not be treated, as the surface obtained in casting is more impervious to moisture than if treated. The absorption of moisture and its liabiliy of freezing may in time injure poor concrete seriously."'

Steel Over Two Thousand Years Old

AT a recent meeting of the Faraday Society of England, Sir Robert A. Hadfield, the president of the Society, in speaking on the subject of "The Hardening of Metals," which was the general topic of the meeting, showed a specimen of steel which he offered as probably the first to be exhibited in modern times of an ancient piece of high carbon steel which had been hardened by quenching. The analysis was as follows:

	Per Cent.
Carbon	0.700
Silicia	0.040
Sulphur	0.008
Phosphorous	0.020
Manganese	0.020
Iron	99.500

In describing it Mr. Hadfield said:

It was possible to obtain a fracture of the specimen, which weighed about 8 oz., was 3 in. in length, 2½ in. in breadth, ½ in. in thickness. This showed fine crystal-line but rather brittle structure. After removing the scale the Brinell ball hardness number was found to be 146. On sawing the specimen in two there was found to be a quite fair proportion of the original metal still unoxidized. I received this specimen a few months ago from the superintendent of archaeology in Western India, Mr. Bhandarkar.

One of the special points is that, notwithstanding the large number of specimens of ancient iron and supposed steel I have examined the last few years, none of them have contained sufficient carbon to be termed steel in our modern-time meaning. This specimen, as will be seen from the above analysis, contains as much as 0.70 per cent. carbon, which indicates that it can be readily hardened by heating and quenching in water. In other words, this material has been in its present condition for probably more than 2,000 years, and now, after being heated and quenched, hardens exactly as if it had been made only yesterday, thus showing that in this long interval and beyond surface oxidation, this specimen has undergone no secular change of structure, or alteration in the well-known capacity of an alloy of iron with carbon to become suddenly possessed of glass-scratching hardness after being heated and quenched in water or other cooling medium.

The photomicrograph of the material in the original condition shows that though variable in structure, and ranging in carbon from about 0.30 to 0.75 per cent., this is of pearlitic type, existing in both lamellar and sorbitic form. The crystallization varies from fine to coarse. In places the structure is blued, as a result probably of mechanical work. There are seams of slag in certain portions, but apart from these the material appears to be of similar type to ordinary modern carbon steel. After quenching from 850 deg. C. in water the steel readily scratches glass and under the microscope reveals the expected martensitic structure.

Mr. Bhandarkar assures me there is not the slightest doubt about the antiquity of this specimen from the bars found beneath the stone pillar of Heliodorus at Besnagar, India. It was found at the bottom of the pillar, dating back to about 125 B. C.

Equipment for Highway Work*

FUNDAMENTALLY, the problem of the selection of economical and efficient plant equipment is the same for the highway departments of states and provinces, counties, and municipalities and contracting companies. The selection of equipment for the construction and maintenance of highways should be based upon a consideration of the following factors: (1) character of work; (2) specification requirements covering plant equipment; (3) amount of work; (4) portability of plant; (5) large and small units; (6) ease of manipulation; (7) adaptability to different classes of work; (8) funds available; (9) depreciation of plant; (10) transportation facilities. The practical necessity for the consideration of many of the above factors is self-evident.

Character of work.—In the case of contractors whose work is confined to the construction of sheet asphalt pavements and in the case of a department such as, for instance, that of Wayne County, Michigan, where the highway work consists primarily of grading operations and the construction of cement-concrete pavements, the problem is materially simplified. On the other hand, where a contractor's work covers the construction of all the various types of roads and pavements used in a municipality, county or state, the selection of the several units of plant equipment should be based upon their adaptability to different classes of work. For example, where cement-concrete pavements as well as concrete foundations are to be constructed, in many cases a type of mixer should be purchased which is satisfactory for the construction of pavements, the requirements for which are more specific than in the case of mixers used only on foundation work.

Specification Requirements Covering Plant Equipment.—In the modern practice of highway engineering, many specifications include specific stipulations which must be met by machines and accessories employed. As illustrations might be cited the weight of rollers, pressure limitations in distributors, grouting apparatus, and details of mixers for the manufacture of bituminous concrete.

Amount of Work, Portability of Plant, Large and Small Units.—It is evident that a contractor or a department will be justified in the purchase of an ideal equipment if the work is to be extensive in character. If the work is centralized and large in amount, as in the case of sheet asphalt work, in many municipalities a large well-equipped permanent plant will prove economical. If, on the other hand, the work is large in amount but distributed over considerable area, small portable units will prove more satisfactory, as in the case of mixing plants for the manufacture of bituminous concrete to be laid on state and county highways.

Ease of Manipulation.—In cases where contractors are engaged in general highway work, and their organization does not include foremen who are specialists in the manipulation of various types of complicated machinery, it is of the utmost importance that simplicity of machines and ease of manipulation should be given great weight in the selection of equipment. This is particularly true in connection with various types of machines used in the construction of bituminous surfaces, bituminous macadam and bituminous concrete pavements.

Adaptability to Different Classes of Work.—It is well-known that specifications for different classes of work requiring the same type of machine call for differences in detail. For grading work specifications might require rollers weighing from 12 to 15 tons, while in the construction of wearing courses of some types of pavements a 10 to 12-ton roller is stipulated. A contractor who is handling a small amount of general highway work would, therefore, find it advantageous to purchase a 12-ton roller suitable for both classes of work mentioned above.

Funds Available.—Departments and contractors are necessarily forced to consider the first cost of equipment, as the funds available may not permit the installation of the most economical and efficient machines. In many cases where such conditions are encountered, it is obvious that it will not be practicable to anticipate that the work can be accomplished with the same degree of rapidity and at the same cost as if more efficient machinery constituted the plant equipment.

Depreciation of Plant Equipment.—Depreciation charges on plant equipment should be given careful consideration prior to the purchase of machines and accessories as well as in the consideration of the cost of highway work.

Transportation Facilities.—Facilities for the transportation of machinery and materials materially affect the efficiency of the several units of plant equipment. For example, in municipalities, counties and states where materials may be transported over highways in good condition, the use of the motor truck will usually be found desirable.

Brief consideration will be given to the plant equipment suitable for grading, quarrying, construction of the several types of roads and pavements, street cleaning and snow removal. The limitations of this paper will prevent the consideration of small tools and accessories. It is also evident that normal conditions usually will be assumed as the basis for suggestion of plant equipment for the various items of highway work enumerated above. Wagons or mortar trucks will be found a necessary part of equipment for all classes of work.

Grading.—Grading operations vary from the scarifying of an old road surface, preparatory to the construction of a new wearing course, to heavy cut and fill work requiring the moving of thousands of cubic yards of material. It is apparent that only extreme conditions can be mentioned in this discussion, as the economics of the utilization of various classes of machines on average grading work would necessitate a comprehensive discussion. For the lightest class of grading mentioned, scarifiers drawn by rollers have proved more economical and efficient than the use of picks in roller wheels or any one of the several types of plows drawn by rollers or tractors. For the heaviest class of grading work, in many instances steam shovels loading into wagons will be found economical. In connection with all grading work except light scarifying, one or more of the following types of machines should form a part of the plant equipment for grading: road drags, grading and rooter plows, drag and wheel scrapers, elevating graders, and rollers. It should be noted that the utilization of the elevating grader has not been fully developed by many contractors. It should also be noted that many engineers and contractors prefer the construction of embankments in thin layers with light smooth faced rollers or sectional rollers instead of the construction of the maximum thickness of layers allowed by specifications and compaction with 15 to 18 ton rollers.

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*Presented before the Pan-American Road Congress at San Francisco, Cal., on Thursday, September 16, 1915, by Arthur H. Blanchard, Professor in Charge of the Graduate Course in Highway Engineering in Columbia University, and Consulting Highway Engineer, New York City.

Quarrying.—Plant equipment for quarrying depends primarily upon the kind of rock, the required output a day, and the length of time during which the quarry will be worked. Drills and blasting devices are a necessary part of all equipment for rock work. Contractors or departments working the quarry to supply material for a specific highway would use the ordinary portable crushing and screening plant consisting of boiler, engine, jaw crusher, elevator, screen and bins. Small quarries, more or less continuously operated, are generally equipped with the above plant except that in many cases the gyratory crusher proves more economical. Passing to the largest quarries, modern equipment for the economical manufacture of broken stone should consist of steam shovels for removing the rock masses from the quarry face to steel cars. In such quarries the pieces of rock transported to the crusher may vary in size up to masses weighing 7 or 8 tons. The rock should be first crushed in a mammoth jaw crusher from which the rock should be passed through a series of gyratory crushers, jaw crushers and rolling mills and thence to elevators, screens and bins. In some plants of this type washing devices are a necessary part of the equipment in order to produce stone chips free from dust.

Earth Roads.—In the construction of earth roads on a large scale, the following equipment has been found to be economically efficient: elevating grader drawn by horses or by a tractor, scrapers, disc and straight-tooth harrows, road drags, rollers and watering carts. The combinations of the machines mentioned which will be used will depend upon the amount of work, character of the soil and the cross-section to which the road is to be built.

Gravel Roads.—Spike-tooth harrows, scrapers, road drags, rollers and watering carts constitute the equipment for the construction of gravel roads. Many engineers and contractors have found grooved rollers more satisfactory for this class of work than smooth-faced rollers.

Broken Stone Roads.—The average equipment consists of harrows, rollers, and watering carts. For many types of construction and kinds of rock, rolling for long periods with 10 or 12 ton rollers has secured a better compaction and economical bond than in cases where 15 and 18 ton rollers have been used for short periods. Some contractors have found automatic screening spreaders a valuable addition to the plant equipment.

Bituminous Surfaces.—The equipment required for the construction of bituminous surfaces depends upon the amount and character of the work and the rapidity with which it must be accomplished. For example, the construction of a bituminous surface on a broken stone road will require an equipment of rotary brushes or coarse fibre brooms, bass fibre brooms, in some cases batteries of heating kettles, a distributor to meet specifications and adaptable for the distribution of the kind of bituminous material under conditions stipulated in the specifications, pouring cans, squeegees, and, in some cases, 5 to 10 ton rollers and hand drawn or horse drawn automatic stone chip distributors.

Bituminous Macadam Pavements.—The equipment will depend primarily upon the specifications and the kind of bituminous material employed. The usual equipment consists of batteries of heating kettles, a distributor, pouring cans, and a roller. The specifications covering certain features of the distributor may be specific, as in the case of the 1914 specifications adopted by the American Society of Municipal Improvements herewith quoted.

> "The pressure distributor employed shall be so designated and operated as to distribute the bituminous materials specified uniformly under a pressure of not less than twenty (20) pounds nor more than seventy-five (75) pounds per square inch in the amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the bituminous material and with an accurate pressure gauge so located as to be easily observed by the engineer while walking beside the distributor. It shall be so operated that, at the termination of each run, the bituminous material will be at once shut off. It shall be so designated that the normal width of application shall be not less than six (6) feet and so that it will be possible on either side of the machine to apply widths of not more than two (2) feet The distributor shall be provided with wheels having tires each of which shall not be less than eighteen (18) inches in width, the allowed maximum pressure per square inch of tire being dependent upon the following relationship between the aforesaid pressure and the diameter of the wheel: For a two (2) foot diameter wheel, two hundred and fifty (250) pounds shall be the maximum pressure per linear inch of width of tire per wheel, an additional pressure of twenty (20) pounds per inch being allowed for each additional three (3) inches in diameter."

Bituminous Concrete Pavements.—The type of pavement, amount of work, the specifications and the kind of bituminous material employed materially affect the selection of the plant equipment for this class of work. Batteries of heating kettles and a roller are required for the construction of all types of bituminous concretes. Although the practice of contractors has varied to a considerable extent with reference to the weight and type of roller, many now favor the 10 to 12 ton tandem roller for all classes with the exception of Topeka bituminous concrete. The practice has also materially varied with reference to the type of mixer employed. It has been demonstrated, however, that for all classes of bituminous concrete work, a contractor, who is to construct a considerable yardage of this type of pavement, should have a mixing plant which includes the following units: heating kettles, elevators, a drier, bins, weighing devices and a pug mill mixer. For pavements of the type of bitulithic, a rotary screen is a necessary adjunct to the plant. For those types of bituminous concrete in connection with which seal coats are employed, the equipment will necessarily be increased by the addition of hand drawn distributors, pouring cans, squeegees, and, in many cases, hand drawn automatic stone chip distributors.

Sheet Asphalt Pavements.—The plant equipment necessarily depends upon the amount and location of the work and the specifications. A tandem roller constitutes a part of the equipment for all sheet asphalt work. The mixing plants are of three types: portable, semi-portable, and permanent. A complete plant includes a cold sand elevator, a drier, a hot sand elevator, a flux tank, melting tank, draw off tank, a sand measuring box, a dust elevator, bin and measuring box, an asphalt cement bucket and a pug mill mixer,

Cement-Concrete Pavements.—Variations in economical equipment depend primarily upon the specifications. A beam and bucket cement-concrete mixer, forms, templates, watering carts, pumps and hose usually constitute the equipment for the construction of cement-concrete pavements constructed by the mixing method.

Wood Block Pavements.—For the building of wood block pavements, the equipment should include the necessary apparatus for the construction of the mortar cushion or a template and hand roller when a sand cushion is employed, a tandem roller weighing from 3 to 5 tons and the necessary distributing apparatus for the application of fillers and the construction of expansion joints.

Brick Pavements.—The equipment should include a wood template and hand roller for the construction of the sand cushion, a tandem roller weighing from 3 to 5 tons, brushes, cement grout boxes if a cement grout filler is employed or conical pouring cans if bituminous fillers are used for the construction of transverse or longitudinal joints.

Stone Block Pavements.—The equipment includes, in some cases, templates and hand rollers for the construction of the sand cushion, tampers and the necessary apparatus for filling the joints.

Street Cleaning.—The equipment required for street cleaning will be in influenced by the types and yardages of roads and pavements. Earth, gravel and broken stone roadways require push brooms or horse drawn or motor driven rotary sweepers and watering carts. Bituminous surfaces and good brick, bituminous and wood block pavements necessitate an equipment for hose flushing and squeegeeing or rotary squeegees and watering carts. Brick, in poor condition, and stone block pavements call for an equipment of hand brooms, rotary brushes, hose for flushing or flushing machines.

Snow Removal.—Equipment for snow removal is affected by the amount of snow in a storm, the yardage and location of the roads or streets to be cleared. For municipal work road scrapers and horse drawn and motor plows have been found economical and efficient. In some cases apparatus for flushing, either hose or power flushing machines have been found advantageous. In the case of many roads, compaction of the snow being principally required, snow rollers constitute the equipment.

Equipment for Maintenance.—In a brief paper it is not practicable to discuss the equipment for maintenance for all the various kinds of roads and pavements. The type of road or pavement, the yardage of each type of highway within a given district and the organization of a highway department or the specifications under which contractors must maintain highways materially affect the selection of an economical and efficient plant equipment.

As an illustration will be cited plant equipment which would prove satisfactory for the maintenance of fifty miles of bituminous macadam and bituminous concrete pavements in a given district. The equipment should include a motor truck and a trailer. The truck would be used for transportation of broken stone, sand, cement, fuel, bituminous materials and, in some cases, small tools and accessories. A trailer should be permanently equipped with a small mixer, drier, and melting kettles. In many cases the following accessories can be used efficiently: a hand drawn gravity distributor, pouring cans which distribute the material in the form of a sheet, conical pouring cans such as are used for the application of bituminous fillers, coarse fibre and bass fibre brooms, a heavy hand drawn roller, tampers, smoothing irons, squeegees, a large hand power bellows, a small surface heater, and other small tools such as shovels and picks. If large areas are to be repaired, a horse-drawn sweeper, a small pressure distributor and a tandem roller should be included in the equipment.

The tower of the Woolworth Building, New York, the highest "sky-scraper" in existence, is now seen in all its beauty and immensity by night as well as by day. An installation of electric projectors renders every architectural detail visible from the roof of the main building to the crow's nest, or lantern, which forms the sixtieth storey. For this purpose 600 lamps, each of 250 watts, similar to those used on motor cars, are used. They are of the new gas-filled type, and while some throw their rays upwards from the gables of the roof on to the sides of the tower, others shine down from the tower top itself, these being hidden by an ingenious system of screens. The surmounting lantern contains twenty large lamps giving together 45,000 candle-power, and by means of diffusing glass and an automatic dimmer, the intensity is constantly varied from a dazzling brilliance to a deep red glow.

A new use has been found for alligators. One of the sewers of a Florida city became clogged. A versatile city official secured an 18-inch alligator, tied a line to him and started him down the sewer. The 'gator went nearly 200 feet and then gave up the job. A 4-foot alligator was obtained and he worked his way for a distance of 400 feet from manhole to manhole, carrying the line with him. A somewhat similar plan was tried at Mazon, Ill. Here a rat with a string attached to its tail, was used as the advance scout. After the rodent had made a fair start, in order to make it move more quickly, a ferret was placed on the trail. The scheme would have worked very nicely but the ferret caught up with the rat and killed it. In the fight, both animals became entangled in the line and so died martyrs to science.

Soft soap may be used instead of oil for lubricating the forms when the inflammability of the oil is objectionable, as soap boiled and applied hot to the forms gives very good results in preventing the adhesion of concrete.

Exposed surfaces of freshly placed concrete should be shaded by boards or tarpaulins to protect them from rain, dust, wind and the hot rays of the sun.

The Design and Construction of a Large Sewage Treatment Plant

Sixteen Imhoff Tanks and Eight Sludge Beds—Tank Effluent Runs Directly Into River—Details of Plans—Difficulties of Deep Excavation for Tanks—Constructing Interceptor Sewer

THE local conditions under which the new sewage treatment plant at Albany, N. Y., is being constructed differ so little from Canadian conditions—at least in the eastern part of the Dominion—that an outline of the design and construction cannot fail to be of interest.

As long ago as 1891 the construction of a system of intercepting sewers together with works for purifying its sewage was contemplated, and in that year plans were made; but nothing more was done at the time. Between 1891 and 1911 the question of sewage treatment often came up, and there was some agitation for a system of disposal to end the river-front pollution, but nothing was done.

In 1911 the common council passed an ordinance providing for the construction of an intercepting sewer, and Hering and Gregory of New York were employed as engineers. Plans for the disposal plant were submitted by them in 1912 and accepted and approved.

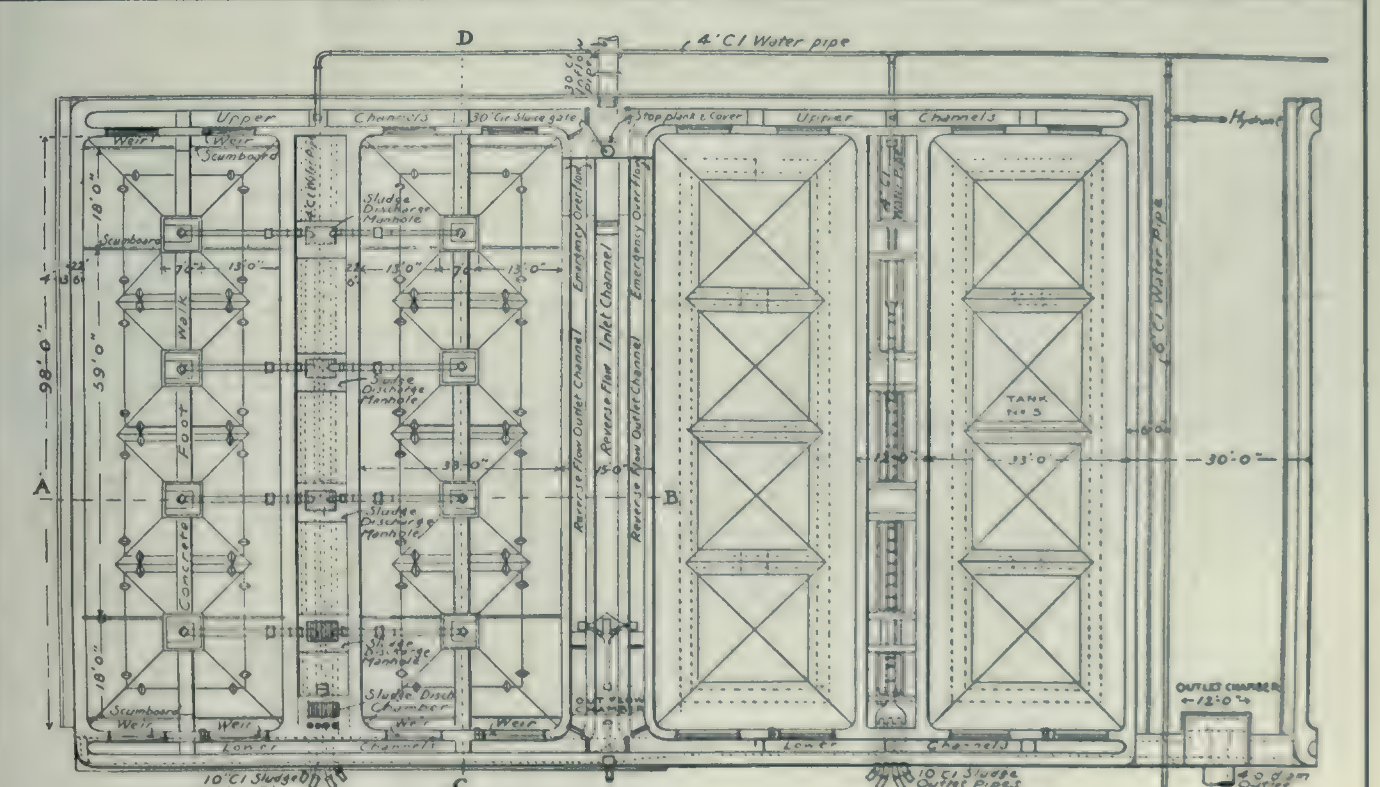
Early in 1914 the contract for the construction of the sewer was let to Henry C. Ulen of Chicago for $356,056, and shortly afterwards the disposal plant contract was let to the Riverdale Contracting Company of New York for $232,362. Four of the sixteen settling tanks and two of the eight sludge-drying beds included in the plans were temporarily omitted from this contract, but these have since been contracted for by the same company at the same unit prices.

The entire cost of the disposal system was estimated as follows:

Intercepting sewer	$ 375,000
Disposal plant	300,000
Pumping station, etc...	300,000
Land, rights of way, etc.	70,000
Engineering and incidentals	55,000
	$1,100,000

Plans for the intercepting sewer included as alternatives monolithic concrete and reinforced concrete pipe. The latter was chosen in awarding the contract as being simpler of construction and offering less obstruction to traffic during building owing to storing material in the streets. It was also considered fully as economical and desirable in other ways. The contract for making the pipe was let to the Lock-Joint Pipe Company, of New York.

The intercepting sewer, beginning in the northeast section of the city, runs in a general southerly direction, paralleling the river, and collects sewage coming down in the old sewers from the high sections of the city. At its upper end it is necessary to build a small pumping station to raise the sewage from low land in the northern section to the level of



Plan of Imhoff tanks, showing four of the sixteen tanks.

the interceptor. Near the southern limits of the city the new sewer crosses Island Creek to Westerlo Island, where the disposal plant is now being constructed.

At the upper end the sewer has a diameter of 24 inches and the depth of excavation is about 10 feet. As it nears the disposal plant the size increases to 27, 36, 42, 48, 54, and finally to 66 inches, and the depth of excavation to 35 feet. On Westerlo Island, near the disposal plant, the depth of excavation is about 23 feet.

The maximum capacity of the interceptor is about 106 cubic feet per second and the calculated velocity varies from 3½ feet per second near the upper end to 6½ feet per second at the lower end. In its entire length of approximately three miles, the fall is a little over 25 feet and the invert at the site of the proposed pumping station on Westerlo Island is 8 feet below mean low water in the Hudson river.

At each intersection of lateral and interceptor is a regulator in the form of a float-operated shear valve adjusted to limit the flow from the tributary into the lateral sewer to a predetermined quantity, any surplus storm water flowing in the present system to the river.

The actual work of constructing the intercepting sewer was begun in July, 1914, with the construction of the Island Creek crossing. A timber trestle on temporary piles was first constructed and corrugated steel sheet piling was driven on each side by steam hammers, forming a coffer dam about 13 feet wide. The piling was driven to a depth three or four feet below the sewer bottom, but some trouble was encountered due to hydrostatic pressure forcing mud up into the trench. Right of way troubles also delayed the work and the crossing was not completed till late in the fall.

In sewer construction in the city where the depth of excavation exceeded about 15 feet, excavating machines made by the Moore Trenching Machine Company, of Syracuse, N. Y., and cableways were used. The former, of which there are three in use, consist of a steel rail track laid over the line of sewer, with an engine at one end, a travelling carriage, buckets, etc. The carriage, which travels on the track and is operated by cable from the engine house, has a working platform about ten feet above the track, steel buckets of one-yard capacity are lowered into the trench, filled by laborers working with pick and shovel, raised to the platform, removed to the completed sewer and dumped. The machine is also used to handle the pipe and lay it in place.

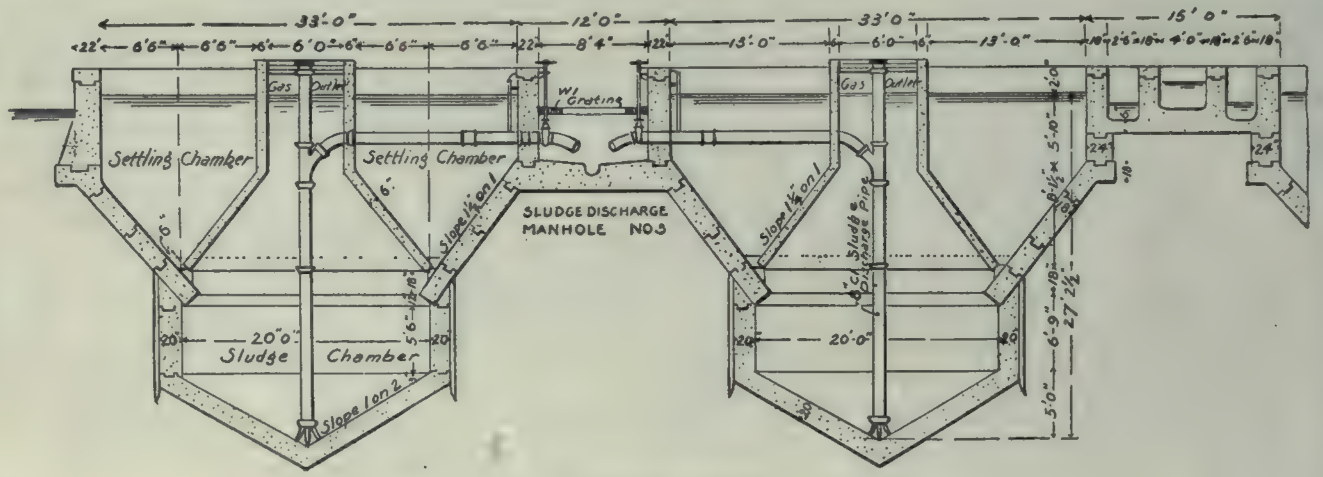
In the southern part of the city where the ground is of soft clay and muck and the excavation is, in some places, 35 feet in depth, construction has been difficult. Tight and careful sheeting was necessary and much of this had to be left in place. There was some settlement of streets and, in a lesser degree, of buildings. A tunnel about 100 feet long had to be driven under the railroad tracks near the creek crossing, but the stiff blue clay, almost impervious to water, which was encountered, made the construction easy, though timbering was necessary. The excavation here was lined with monolithic concrete.

Since the invert of the sewer on Westerlo Island is 8 feet below mean low water and since it was deemed necessary, in order to insure the operation of the plant during times of high water, that the surface of the sewage in the tanks be 22 feet above mean low water, a pumping plant to raise the sewage about 30 feet will have to be constructed. Plans for this pumping station and for the grit chamber have not yet been completed.

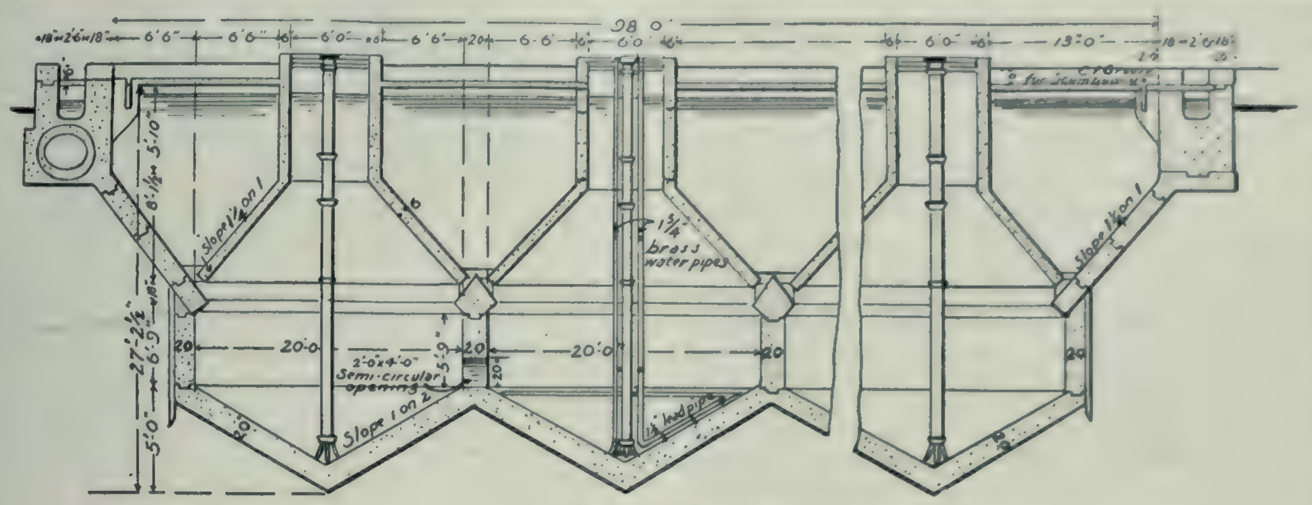
The intercepting sewer will carry the dry weather flow of sewage to the grit chamber, where the velocity will be reduced to about one foot per second, so that a large part of the mineral suspended matter will be deposited. Bar screens will remove the larger floating and suspended substances. From the grit chamber the sewage will be lifted by the pumps to the settling tanks.

These consist of sixteen Imhoff tanks designed to handle an average flow of 3,000,000 gallons per day, the average time of retention being three hours. The tanks are arranged in batteries of four, each battery being fed by a 30-inch cast iron off-shoot from the force main.

The tanks are 33 feet wide, 98 feet long and 27 feet 2½ inches deep from the surface of the liquid to the floor of the sludge chamber. Each tank has one upper settling chamber and four lower sludge chambers. The sidewalls of the settling chambers are vertical for a depth of 5 ft. 10 in., and below this have a uniform slope of 1¼ on 1. The sides of the sludge chambers also are vertical and 5 ft. 6 in. high, forming pockets 20 ft. square, with hopper bottoms sloping 1 on 2. The four sludge chambers of each tank are connected in pairs by two semicircular openings at the bottom,



Vertical section on AB.



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each 2 ft. by 4 ft. These chambers are designed to retain the sludge for from three to six months.

Each of the four sludge chambers of each tank is continued upward through the settling chamber as a tapering chimney 6 ft. square on top, thus giving for each 33 by 98 ft. tank four gas outlets each 6 ft. square, or a total area equal to 4½ per cent. of that of the settling chamber.

Each group of four tanks is further arranged in pairs, a sludge channel being located between the two tanks of each pair, and reverse-flow outlet and inlet channels between the two pairs. In each sludge channel are four manholes, one opposite each gas outlet chimney. An 8-inch cast iron sludge discharge pipe rises vertically from the centre of each hopper bottom to the top of the chimney, with a horizontal branch 3 ft. 8 in. below the sewage surface carried across the settling chamber and discharging into the sludge manhole, where it is controlled by a gate valve. Passing through the middle of the sludge channel is the main sludge discharge pipe, 10 in. vitrified pipe in concrete, which receives the sludge at the manholes and carries it to a sludge discharge chamber, whence four 10 in. cast iron pipes distribute it to the sludge drying beds.

A 4 in. water pipe is connected with the upper end of each main sludge discharge pipe for the purpose of flushing it out. Two 1¾ in. brass water pipes are carried down the side of each vertical sludge discharge pipe to the bottom of the sludge chamber, where four 1½-in. lead pipes branch off, one up each slope of the bottom and around the sides, these pipes having ⅛-in. holes at 18 in. intervals; the purpose of this being to wash the sludge to the foot of the sludge discharge pipe is necessary.

The sewage receives no other treatment than that from the tanks, the effluent being collected in outflow chambers and discharged through a 60-inch outfall conduit into the Hudson. The effluent from the sludge drying beds also is discharged through this conduit.

The sludge beds are eight in number, each 80 feet wide by 104 feet long. The beds are divided by 2-inch concrete partition walls 15 inches high in sections 20 feet by 104 feet. The underdrains, 3 inches in diameter, are laid with ½-inch open joints in lines spaced 13 feet centre to centre, at right angles to the partition walls. These drain into an 8-inch vitrified tile main drain laid with cement joints. This drain discharges into a manhole whence the effluent passes into the outfall conduit.

The beds, which are from 10 to 14 inches in depth, are filled with a ¼-inch gravel layer of sand on 2 inches of 1/16-inch to ¼-inch gravel, under which is 4 inches of ¼-inch ¾-inch gravel and 4 to 7 inches of 1-inch to 2½-inch gravel. Dried sludge will be removed by cars running over tracks of 24-inch gauge laid on the sludge beds and will be used to fill low places.

The 60-inch outfall conduit, which is about 1,000 feet in length, is of concrete. Much of it is laid on a timber foundation, supported on piles and constructed within a timber cofferdam of triple lap sheet piling left in place. The supporting piles were driven three in a row and the rows spaced five feet apart, the depth averaging 23 feet below the foundation timbers. The flow line is in general one foot below mean low water in the river, but in the last twenty feet through the river dike the outfall drops abruptly to a flow line elevation 8 feet below mean low water.

The construction of the disposal plant includes about 50,000 yards of embankment. Part of this is used in the construction of a dike about 11 feet high around the entire plant to protect it from high water. Also, as the top of the settling tanks are to be at elevation 24.0, it was necessary to construct the greater part of them in fill. Practically all the embankment was completed last fall and allowed to settle during the winter, hollows being left where the settling tanks were to be constructed.

It was necessary to use coffer-dam construction in excavating for the tanks this spring. Three-inch yellow pine tongue and groove sheet piling was driven, the first few feet by hand and the rest by steam hammers, to a depth about three or four feet greater than the excavation. It has been found that the piling is not heavy enough, and this depth is not sufficient, as hydrostatic pressure is forcing mud and soft clay up into the excavation. The plans originally provided for 2½ by 5-inch reinforced concrete piling for this construction, but this was abandoned in favor of the yellow pine.

The first six tanks are now nearly ready for concreting and excavation will soon be started on the second block of six tanks. A 75-foot derrick handles and removes all material from two of the tanks, while an 80-foot derrick is able to reach four tanks. One-yard and 1½-yard buckets are lowered into the pits, filled by hand, raised and dumped, the material being used as cover for the outfall conduit. Ten men are usually assigned to each tank for excavation. Pumping is necessary, as considerable water has been encountered and there are three Pulsometers, and six Cameron pumps at work.

Two sets of forms are being constructed and the tanks will be concreted, two at a time. Owing to the small amount of concrete to be poured in any one spot, it is not likely that any large concrete tower will be erected but the gasoline mixers of which there are two on the job will be moved from place to place as required .A cableway may be constructed which will be used first in excavating and later in handling concrete, forms, etc.

Work has not yet been started on the sludge drying beds but the grading for them is nearly finished, and as soon as the outfall sewer is completed, their construction will be begun.

Three hoists, one National, one Lidgerwood and one Mundy, are in use on the two derricks mentioned and a 60-ft. stiff leg derrick which is used for general purposes. The steam hammers, a National and a Hamilton, have been used to drive piling. The equipment also includes one Shafer steam-operated concrete mixer and two Lansing gasoline mixers.

The contract involves about 50,000 yards of embankment, 25,000 yards of excavation, 15,700 yards of concreting, 6,480 feet of vitrified sewer, 205 tons cast iron pipe, 7,000 feet of piling and 560,000 pounds of steel reinforcement.

Canvas Air Duct in Tunnelling

THE innovation introduced by the contractors in their tunnelling work on the Mill Creek sewer in St. Louis—canvas tubing for air conduit—claims attention for application to all future tunnelling as well as other construction work where low-pressure air has to be piped. The contractors report not only a gain in first cost, but—what is more important—a saving of delay and trouble in handling the air pipe at the heading just before and after shooting.

The job was started with galvanized iron ducts in the shaft and the headings. On account of the time lost after shooting in re-extending the air pipe to the heading, the contractor took up with the Bemis Bros. Bag Company the question of supplying some form of flexible conduit. Experiments led to producing a duct or tube of heavy rubberized fabric, in sizes up to 24-in. diameter, which was practically air-tight and water-tight, and was much cheaper than galvanized iron pipe. Made up in 100-ft. lengths, and joined by a special coupling—an inside metal sleeve grooved at both ends, with clamping rings fastened over the ends —it can be rolled up or re-extended very rapidly.

At the shaft the contractor has a 15 x 24-in. Jeffrey blower, delivering 10,000 cu. ft. per min. under 2-in. water head. A 24-in. tube of the rubberized fabric—called "Flexoid"—carries the air down the shaft, and from here a 16-in. Flexoid tube leads it to the headings, about 1,600 feet each way from the shaft.

Mr. D. H. Blanks, engineer for the contractors, Thos. Connor & Sons, estimates that just before shooting, the blower having been shut down, one man can roll up the duct for 200 ft. or more in one or two minutes, and that it can be replaced in even less time after shooting. This is a great saving in labor over the corresponding handling of metal duct.

The Flexoid duct has been in use for five months, and a portion of it has been replaced. Mr. Blanks considers that its life would be much greater in a perfectly dry tunnel, the loss to date having been largely due to weakening from damp rot. As matters stand, however, he figures that by the time the excavation is finished, about eight months in all, the whole installation will have been replaced once. This still represents a great saving in first cost, as the Flexoid costs only about 20 per cent. as much as sheet-metal piping.

The makers of the canvas duct believe it can also be used as temporary water conduit in many instances. Its chief field, however, is ventilating air service. Because it is simple to handle and does not obstruct other work, it may lead to putting in ventilation in shaft or deep trench work, now done without ventilation.—Engineering News.

Rerolling Rail Steel

Resulting Products a Considerable Factor in a Number of Lines

By C. A. Tupper

THE rerolling or working up of rail steel for industrial purposes has assumed considerable importance. The production of bars for reinforcing concrete is probably the largest single use for rerolled rail heads, while flats, channels, angles, tees and diamonds can be secured from the rail section as a whole, including the web and flange, together with straight and U bars of various dimensions. Such bars and shapes now find an extremely varied application, as in the manufacture of agricultural machinery and implements, such as spreaders, plows, harrows, cultivators, mowers, rakes and harvesters. This is, in point of tonnage, the most considerable use and includes all of the material above mentioned, with some special shapes.

The furniture industry affords another important outlet, including bars and angles for metal beds, couches and springs, especially the numerous combination and folding types used in apartment buildings. Likewise metal school and office furniture, store fixtures, show cases, etc., take large quantities. Wagon and carriage builders are naturally among the heaviest consumers. Bars for sleigh shoes and runners and for toe calk steel also come from rerolled sections. In a similar category are boat keels, angles and clamps. In the manufacture of narrow gauge cars and trucks, wheelbarrows, and other conveying or transfer equipment a rapidly growing use for the material is found. Apparatus for exercise and play, represented to the greatest extent by lawn swings, takes an appreciable quantity of bars and angles, with some minor specialties.

The production of builders' hardware offers a further field, and one fast being extended, for the utilization of rerolled steel, particularly the smaller shapes made from webs and flanges. Angles and bars for telegraph and telephone line material were called for early in this movement, followed by their application to electric power and railroad systems for transmission, feeder and trolley circuits, also as hangers for electric transformers and lightning arresters and as built-up poles or supports for various electric power equipment. Analogous to the last named is the use of bars and angles for power line towers or wind mill towers, where their service in withstanding the shock and strain of storms, vibration from the passage of heavy interurban cars, etc., has been notably good.

With the return of normal prosperity a factor in the situation will be the availability of this material in lots suited to the requirements of the average manufacturer, who is otherwise apt to be placed at a disadvantage compared with larger buyers or those more forehanded in placing orders. Mills rolling bars and angles from rail steel are generally in a position to make quicker shipments of short lengths and varied sizes than other plants, and they naturally have a greater interest in caring for this class of trade.

It is to be noted further that the extension of rerolled rail steel products into so many branches of manufacturing is a matter of congratulation to the entire metal field, because of the impulse it has given to all accessory lines, such as bolts, nuts and screws. Also, by maintaining the scrap value of old rails, it should add to the likelihood of replacements, and in this way exert an influence decidedly beneficial to the industry as a whole.—The Iron Age.

Experiences in Calking Joints in Water Mains

AFTER using leadite for calking water-main joints for ten years, the Chief Engineer and General Superintendent of the Pennsylvania Water Company at Wilkinsburg, Pa., Mr. W. C. Hawley, has concluded that it is far superior to lead, and can be used in place of the latter in every instance except occasionally in a street when a joint immediately under some pipe or other obstruction is inaccessible, and would thus be troublesome to reach in case it leaked and could be repaired by a little calking. His reasons for favoring leadite were given in detail in a paper read before the convention of the New England Water-Works Association in New York this week. Mr. Hawley finds also that for ease in application, for resistance to shock and to the passage of electric current, and cost, leadite has decided advantages over lead.

The following paragraphs, abstracted by The Engineering Record, give the chief points made by Mr. Hawley:

When leadite joints have been properly made, a large percentage of them when tested should be found to be practically tight. There may be a small amount of seepage, and in a very few cases even an appreciable leakage indicated by water dropping from the joint or small spray. Practically all of these will take up tight within twenty-four hours, and such as do not become tight are readily made so by cutting out the portion which is leaking and re-running with leadite, or in case there is too much water the portion of the joint which has been cut out can be filled with lead wool. If more than 1 or 2 per cent. of the joints made show leakage after twenty-four hours, it is an indication that the joints were not properly made. In a line of 12, 10 and 8-in. pipe, five miles long, laid several years ago and tested in the open trench, there was but one leaking joint. This was repaired by cutting out part of the joint and re-running.

Lead has but one advantage over leadite, namely, that after having been run the joint can be calked. The calking adds materially to the expense of the joints, but there will be occasionally in a city street a joint immediately under some pipe or otherwise inaccessible, where it may be advisable to use lead so that in case of the joint being disturbed and leaking in the future it can be readily repaired by calking, whereas if it was leadite it might be necessary to run a new joint or to cut out part of it and replace with lead wool.

Advantages

In practically all other respects leadite has the advantage over lead. Leadite costs about 10 cents per pound, lead about 5 cents; but leadite weighs about one-fifth as much as lead, and hence its cost per unit of volume is about two-fifths that of lead. Leadite requires no calking, and this, as will be shown later, is a material saving, not only in the cost of the labor of calking but in the digging of large bell holes. In addition there is the saving in cost of inspection in order to insure well-calked joints. There is the further saving in the maintenance of the ditch and bell hole during the time that the joint is being calked and inspected. This is an important item in bad ground or in wet trenches.

In a case where there is limited room for calking, leadite has marked advantage over lead. Some years ago I had a 30-in. pipe burst, the bell of which was very close to a concrete wall. It was barely possible to yarn and run the joint with leadite. Had we been compelled to use lead it would have required hours of time to have cut out sufficient concrete to have permitted the calking of the joint. It was imperative that the pipe be repaired quickly, as a large community depended upon the line for its supply.

Leadite has another advantage over lead in the fact that it is so much lighter and hence more easily carried to the joint. When lead is at a temperature suitable for pouring it oxidizes rapidly, and in spite of the utmost care the oxide and dross which gathers on the surface will sometimes be poured into the joint. There is no trouble of this kind with leadite.

Elasticity

Since lead has practically no elasticity, any movement of pipe laid with lead, or any continued shock or vibration to the pipe tends to loosen the lead in the joints, or in many cases to squeeze it out altogether. Leadite being elastic, is not so affected. In one case a 20-in. cast-iron pipe laid with lead passed under a main line of a railroad on which the traffic was very heavy. For years it had been necessary to periodically [illegible] About ten years ago the lead in these joints was replaced with leadite, and I am advised that there has not been a leak in these joints since.

Considering the brittle nature of leadite, it is surprising what a leadite joint will stand in the way of movement without serious damage. This has been illustrated in my own experience several times by side hill slips, and in one case where it was necessary to lower a line of 8-in. pipe for a distance of nearly 300 feet and to a maximum depth of about 2 feet. The pipe had been laid with leadite and it was not supposed that it could be lowered without damage to most of the joints, which would probably require them to be remade. It was decided, however, to try the experiment, and the pipe was lowered and to our surprise the joints remained tight.

Since leadite melts at such a low temperature (240 deg. Fahr.), there is no danger of an explosion, should it be necessary to run a wet joint. Among leadite's good qualities is the fact that it offers a high resistance to the flow of electricity, thereby reducing materially the danger of damage by electrolysis.

Last, but not least of leadite's good qualities is the saving by its use compared with lead. Roughly speaking, on the ordinary sizes of pipe and under average conditions, this amounts to at least one-half of the cost of lead joints. In my own experience, since leadite was a new material and our pressures unusually high, I have made leadite joints with a depth of from 2⅛ to 2½ in., whereas with lead the joints would be made from 1¾ to 2 in. in depth. Used in this way we find on the average that the amount of leadite and lead required for joints of different sizes is as shown in the accompanying table.

Average Quantities of Leadite and Lead Required for Joints of Various Sizes of Cast-Iron Pipe

Diameter, in.	Leadite, lb.	Lead, lb.
4	2 = (Diam./2)	7 = 2 Diam. — 1
6	3 "	10 = 2 Diam. — 2
8	4 "	13 = 2 Diam. — 3
10	5 "	17 "
12	6 "	21 "
14	7 "	25 "
16	8 "	29 "
20	10 "	37 "
24	12 "	45 "
30	15 "	57 "
36	18 "	69 "

On this basis, assuming the cost of leadite at 10 cents per pound and lead at 5 cents, lead costs from one and three-quarters to nearly twice as much as leadite.

Labor costs vary according to the length of pipe laid and the difficulties encountered, but we have found on the average the labor in making leadite joints, including the melting of the material, the preparation and placing of the roll, yarning and pouring the joint, is one-half of the corresponding cost of making lead joints, including the calking, this without making any allowance for the extra cost of inspecting lead joints or for digging bell holes large enough for calking. As an example of what can be done under good conditions, we have had three men yarn, melt and pour ninety-five joints of 8-in. pipe in one day, at a total cost for labor of $6.60, or a cost of 7 cents per joint. The total cost, including leadite, was $49, or an average cost per foot of pipe of 4.3 cents. In this case the saving is well over 50 per cent. of the cost of making the same joints with lead.

In regard to relative cost of a reinforced concrete fireproof mill and one with brick walls and wooden floors, the former used to cost about 15 per cent. more, on the aoverage. As improved methods have been developed in the handling of men and materials on reinforced concrete, the prices have more nearly approached one another. In a number of cases they meet, and in a few cases the reinforced concrete building is cheaper in first cost.—L. C. Wason.

Skewed joints for concrete roads, instead of joints at right angles to the direction of traffic, are recommended by C. H. Moorefield and James T. Voshell, of the U. S. Office of Public Roads. With the joint at right angles the two wheels of a vehicle strike the joint at the same time and thus produce the maximum amount of impact. By skewing the joint at an angle of about 15 degrees the wheels strike one at a time, and the total resultant impact is reduced by at least one-half. This is advantageous to the traffic and the pavement both, and since the difficulties involved in constructing skewed joints are not at all serious, there is no apparent objection to their use. Wider angles of skew have not proved satisfactory, as the sharp corners frequently cracked.

New Apparatus Determines Fineness of Cement

THREE years experiments intended to produce a means of determining the exact fineness of cement have resulted, at the U. S. Bureau of Standards, in the developing of an apparatus which is effective for this purpose. In the manufacture of Portland cement, clay or shale and limestone are ground together and "burned" in rotary kilns. The cement comes from the kilns in the form of hard, black, semivitreous lumps, or "clinker." When pulverized this clinker becomes a grayish powder, which is the familiar article of commerce employed for a great variety of purposes in practically every type of building construction.

It has long been known that the fineness to which the cement is ground is one of its most important characteristics, and consequently specifications require that 75 per cent. or more of commercial cement shall pass through a No. 200 sieve, which has 40,000 openings per square inch. This is the practical limit of mechanical sieves in respect to fineness.

It is very important to have some means of measuring directly the entire state of subdivision of cement; in other words, to discover just what percentage of the material is made up of particles of certain definite sizes. If such a division can be made, it should be possible not only to compare the efficiency of different grinders, but also to determine what degree of fineness must be attained before the cement becomes "hydraulically active"—that is, capable of combining with water to form the binding material in mortar and concrete.

The apparatus devised by the Bureau of Standards consists of a vertical brass pipe, about 3 inches in diameter and 5 feet long, at the lower end of which is attached a glass bulb in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and as the air can escape only through the vertical stack it carries with it the cement dust, which is caught in a flannel hood surmounting the stack. The air flow in the stack is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. This residue is weighed and the amount of dust is determined by subtracting the weight of the residue from that of the original sample of cement. Different grades are obtained by using different-sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standardized without reference to the size of the nozzles and other parts of the apparatus or the air pressure used.

It is found that the cement"flour"—that is, the portion of cement which contains no perceptible grit when rubbed between the fingers—consists of particles less than 0.007 inch in diameter. The apparatus is called the air analyzer, and may be used for separating and grading any hard-grained materials, such as ground quartz, emery, and other abrasives. The air analyzer in modified form is also capable of separating many other powders, for example, paint pigments, plasters, clays, and similar materials.

Officially-Recommended Spelling and Definitions of Important Road-Building Terms

THE American Society of Civil Engineers has presented a report recommending the nomenclature given below for materials and methods used in road construction. For the sake of uniformity and clearness, the committee recommends that this list of terms of frequent use in expressions relating to highway work be recognized as having the meanings set forth in the list, unless otherwise definitely stated at any time by a user of such term or terms. The committee further recommends that new terms or phrases, coined with the idea of expressing delicate shades of meaning through the medium of one or two words rather than by longer expressions, be suggested or used only after full, careful, and conservative consideration, for the sake of avoiding the utmost confusion in the use of terms.

In the list will be found some terms and definitions adopted by the American Society for Testing Materials, noted thus*; others by the American Reporters on Communication No. 10 at the Third International Road Congress, designated thus†; and other terms and definitions which have been proposed by the Committee on "Standard Tests for Road Materials" (Committee D 4) of the American Society for Testing Materials, which have been indicated thus‡.

DEFINITIONS

Aggregate—The mineral material, such as sand, gravel, shells, slag, or broken stone, or combinations thereof, with which the cement or the bituminous material is mixed to form a mortar or concrete. Fine aggregate may be considered as the mineral inert material which will pass a ¼-in. screen, and coarse aggregate the material which will not pass a ¼-in. screen.

Asphalt—Solid or semi-solid native bituminous, solid or semi-solid bitumens obtained by refining petroleums, or solid or semi-solid bitumens which are combinations of the bitumens mentioned with petroleums or derivatives thereof, which melt on the application of heat, and which consist of a mixture of hydrocarbons and their derivatives of complex structure, largely cyclic and bridge compounds.

Asphalt Block Pavement—One having a wearing course of previously prepared blocks of asphaltic concrete.

Asphalt Cement—A fluxed or unfluxed asphaltic material, especially prepared as to quality and consistency, suitable for direct use in the manufacture of asphaltic pavements, and having a penetration between 5 and 250.

Asphaltenes—The components of the bitumen in petroleum, petroleum products, malthas, asphalt cements, and solid native bitumens, which are soluble in carbon disulphide, but insoluble in paraffin napthas.

Asphaltic—Similar to, or essentially composed of, asphalt.

Base—Artificial foundation.

Binder—(1) A foreign or fine material introduced into the mineral portion of the wearing surface for the purpose of assisting the road metal to retain its integrity under stress, as well as, perhaps, to aid in its first construction. (2) The course, in a sheet-asphalt pavement, frequently used between the concrete foundation and the sheet-asphalt mixture of graded sand and asphalt cement.

Bitumen—A mixture of native or pyrogenous hydrocarbons and their non-metallic derivatives, which may be bases, liquids, viscous liquids, or solids, and which are soluble in carbon disulphide.

Bituminous Cement—A bituminous material suitable for use as a binder, having cementing qualities which are dependent mainly on its bituminous character.

Bituminous Concrete Pavement—One composed of stone, gravel, sand, shell, or slag, or combinations thereof, and bituminous materials incorporated together by mixing methods.

Bituminous Macadam Pavement—One having a wearing course of macadam with the interstices filled by penetration methods with a bituminous binder.

Bituminous Material—Material containing bitumen as an essential constituent.

Liquid Bituminous Material—‡Bituminous material showing a penetration at normal temperature under a load of 50 grammes applied for 1 sec., or more than 350.

Semi-Solid Bituminous Material—‡Bituminous material showing a penetration at normal temperature under a load of 100 grammes applied for 55 sec., of more than 10; and under a load of 50 grammes applied for 1 sec., of not more than 350.

Solid Bituminous Material—‡Bituminous material showing a penetration at normal temperature under a load of 100 grammes applied for 5 sec., of not more than 10.

Bituminous Pavement—One composed of stone, gravel, sand, shell, or slag, or combinations thereof, and bituminous materials incorporated together.

Bituminous Surface—A superficial coat of bituminous material with or without the addition of stone or slag chips, gravel, sand, or material of similar character.

Blanket—See "Carpet."

Bleeding—The exudation of bituminous material on the roadway surface after construction.

Blown Petroleums—†Semi-solid or solid products, produced primarily by the action of air upon originally fluid native bitumens which are heated during the blowing process.

Bond—The combined action of inertia, friction, and of the forces of adhesion and cohesion, which helps the separate particles composing a crust of pavement to resist separation under stress. Mechanical bond is the bond produced almost wholly, in a well-built broken-stone macadam road, by the interlocking of angular fragments of stone, and the subsequent filling of the remaining interstices with the finer particles.

Bound—Bonded.

Water-Bound—Bonded with the aid of water.

Bituminous Bound—Bonded with the aid of bituminous material.

Brick Pavement—One having a wearing course of paving bricks or blocks.

Bridge—A structure for the purpose of carrying traffic over a gap in the road-bed measuring 10 ft. or more in the clear span.

Camber of a Road—See "Crown."

Camber of a Bridge—The rise of its centre above a straight line through its ends.

Carbenes—†The components of the bitumen in petroleums, petroleum products, malthas, asphalt cements, and solid native bitumens, which are soluble in carbon disulphide, but insoluble in carbon tetra-chloride.

Carpet—A bituminous surface of appreciable thickness, generally formed on top of a roadway by the application of one or more coats of bituminous material with gravel, sand, or stone chips added.

Cement—An adhesive substance used for uniting particles of other materials to each other. Ordinarily applied only to calcined "cement rock," or to artificially prepared, calcined. and ground mixtures of limestone and silicious materials. Sometimes used to designate bituminous binder used in bituminous pavements, when the expression "bituminous cement" (q. v.) is understood to be meant.

Cement-Concrete—An intimate mixture of gravel, shell, slag, or broken stone particles, with certain proportions of sand or similar material, cement, and water, made previous to placing.

Cement-Concrete Pavement—One having a wearing course of hydraulic cement concrete.

Cemented—Bonded. Referring to water-bound macadam, the term "cemented" is used to designate that condition existing when, after rolling the stone forming the crust, the remaining voids have been filled with the finer sizes, and the stone dust or "flour" has, under the action of water, taken a "set," as does cement itself.

Chips—Small angular fragments of stone containing no dust.

Clay—Finely divided earth, generally silicious and aluminous, which will pass a 200-mesh sieve. Also see "Gravel."

Coal Tar—†The mixture of hydrocarbon distillates, mostly unsaturated ring compounds, produced in the destructive distillation of coal.

Coat—See "Carpet." (1) The total result of one or more single surface applications. (2) To apply a coat.

Coke-Oven Tar—†Coal-tar produced in by-product coke ovens in the manufacture of coke from bituminous coal.

Consistency—‡The degree of solidity or fluidity of bituminous materials.

Course—One or more layers of road metal spread and compacted separately for the formation of the road or pavement. Courses are usually referred to in the order of their layings as first course, second course, third course, etc. Also a single row of blocks in a pavement.

Crown—The rise in cross-section from the lowest to the highest part of the finished roadway. It may be expressed either as so many inches (or tenths of a foot), or as rate per foot of distance from side to centre, i. e., "the crown is 4 in.," or "the crown is ½ in. to the foot."

Crusher Run—The total unscreened product of a stone crusher.

Crusher-Run Stone—The product of a stone-crusher, unscreened except for the removal of the particles smaller than remaining on about a ¼-in. screen.

Crust—That portion of a macadam or similar roadway above the foundation, consisting of the road metal proper with its bonding agent or binder.

Culvert—A structure for the purpose of carrying traffic over a gap in the road-bed measuring less than 10 ft. in clear span.

Cut-Back Products—Petroleum, or tar residuums, which have been fluxed, each with its own or similar distillates.

Dead Oils—*Oils, with a density greater than water, which are distilled from tars.

Dehydrated Tars—†Tars from which all water has been removed.

Ditch—The open-side drain of a roadway, usually deep in proportion to its width, and unpaved.

Drainage—Provision for the disposition of water.

Side-Drainage—That along the sides of the roadway.

Sub- or Under-Drainage—That below the surface.

Surface Drainage—That on the roadway or ground surface.

V-Drainage—That provided by the construction of troughs in the sub-grade of the roadway, which troughs are like a "V" with flat sloping sides, and are filled with stone.

Dust—Earth or other matter in fine, dry particles, so attenuated that they can be raised and carried by air currents. The product of the crusher passing through a fine sieve.

Dust Layer—Material applied to a roadway for temporarily preventing the formation or dispersion under traffic of distributable dust.

Earth Road—A roadway composed of natural earthy material.

Emulsion—A combination of water and oily material made miscible with water through the action of a saponifying or other agent.

Expansion Joint—A separation of the mass of a structure, usually in the form of a joint filled with elastic material, which will provide opportunity for slight movement in the structure.

Fat—Containing an excess. A fat asphalt mixture is one in which the asphalt cement is in excess and the excess is clearly apparent.

Filler—(1) Relatively fine material used to fill the voids in the aggregate. (2) Material used to fill the joints in a brick or block pavement.

Fixed Carbon—*The organic matter of the residual coke obtained upon burning hydrocarbon products in a covered vessel in the absence of free oxygen.

Flour—†Finely ground rocks of minerals pulverized to impalpable product.

Flush Coat—See "Seal Coat."

Flushing—(1) Completely filling the voids. (2) Washing a pavement with an excess of water.

Flux—†Bitumens, generally liquid, used in combination with harder bitumens for the purpose of softening the latter.

Footway—The portion of the highway devoted especially to pedestrians. A sidewalk.

Foundation—The portion of the roadway below and supporting the crust or pavement.

Artificial Foundation—That layer of the foundation especially placed on the sub-grade for the purpose of reinforcing the supporting power of the latter itself, and composed of material different from that of the sub-grade proper.

Free Carbon—*In tars, organic matter which is insoluble in carbon disulphide.

Gas-House Coal-Tar—†Coal-tar produced in gashouse retorts in the manufacture of illuminating gas from bituminous coal.

Grade—(1) The profile of the centre of the roadway, or its rate of rise or fall. (2) Elevation. (3) To establish a profile by cuts and fills or earthwork. (4) To arrange by sizes, broken stone, gravel, sand, or combinations of such materials.

Gravel—Small stones or pebbles usually found in natural deposits more or less intermixed with sand, clay, etc., but in which mixture the particles which will not pass a 10-mesh sieve predominate; gravel, clay, gravel sand, clayey gravel, and sandy gravel indicate the varying proportions of the finer-sized particles. The differentiation between gravel, sand, silt, and clay should be made on the following basis:

Size of Particles	Names
Retained on a 10-mesh sieve	Gravel
Passing a 10-mesh and held on a 200-mesh sieve	Sand
Passing a 200-mesh sieve	Silt or clay

Pea Gravel—Clean gravel the particles of which equal peas in size.

Grit—Stone, slag chips, or small gravel free from finer material.

Gutter—The artificially surfaced and generally shallow waterway provided usually at the sides of the roadway for carrying surface drainage. Occasionally used synonymously with "ditch," but incorrectly so, as "gutters" are always paved or otherwise surfaced, and ditches are not.

Haunches—The sides or flanks of a roadway. Sometimes also called "quarters."

Highway—The entire right of way devoted to public travel, including the sidewalks and other public spaces, if such exist.

Layer—A course made in one application.

Loam—Finely divided earthy material containing a considerable proportion of organic matter.

Macadam—A road crust composed of stone or similar material broken into irregular angular fragments compacted together so as to be interlocked and mechanically bound to the utmost possible extent.

Mastic—A mixture of bituminous material and fine mineral matter suitably made for use in highway construction and for application in a heated condition.

Mat—†See "Carpet."

Matrix—A composition or material forming a cushion, or binding the aggregate together.

Mesh—The square opening of a sieve.

Metal—See "Road-Metal."

Mortar—A mixture of fine material such as sand, cement, and water or other liquid, suitably proportioned and incorporated together for the purpose for which it is used.

Mush—A greasy mud sometimes found on bituminous crusts.

Normal Temperature—‡In laboratory investigations, 25 deg. cent. (77 deg. Fahr.).

Oil-Gas Tars—Tars produced by cracking oil vapors in the manufacture of oil gas.

Patching—Repairing or restoring small isolated areas in the surface of the metalled or paved portion of the highway.

Palliative—A short-lived dust layer.

Pavement—The wearing course of the roadway or footway, when constructed with a cement or bituminous binder, or composed of blocks or slabs, together with any cushion or "binder" course.

Penetration—In laboratory investigations, the distance, expressed in tenths of a millimeter, entered a sample by a No. 2 cambric needle operated in a machine for the purpose and under known conditions of loading, time, and temperature. The degree of solidity of bituminous materials.

In construction, the entrance of bituminous material into the interstices of the metal of the roadway.

Penetration Method—The method of constructing a bituminous-macadam pavement by pouring or grouting the bituminous material into the upper course of the road metal before the binding of the latter has been completed.

Pitch—†Solid residue produced in the evaporation or distillation of bitumens, the term being usually applied to residue obtained from tar.

Hard Pitch—Pitch showing a penetration of not more than ten.

Soft Pitch—Pitch showing a penetration of more than ten.

Straight-Run Pitch—‡A pitch run in the initial process of distillation, to the consistency desired without subsequent fluxing.

Pocket—A hole or depression in the wearing course.

Pot-Hole—A hole extending below the wearing course.

Profile—A longitudinal section of a highway, generally taken along the centre line.

Quarters—The four sections of equal width which, side by side, make up the total width of a roadway.

Ravelling—The loosening of the metal composing the crust.

(Concluded in next issue.)

The Business Relation Between Contractor and Engineer

THERE is a more or less prevalent idea among many taxpayers and some few engineers that contractors as a class are dishonest. This opinion is generally formed by a very limited experience in dealing with contract work.

The nature of a contractor's work, especially when he is engaged on public work, readily yields itself to criticism. Quite often we hear a contractor condemned for a poor piece of work when the blame properly belonged on the engineer. There have been instances of bridge failures and examples of unsatisfactory roads and pavements when the contractor was entirely innocent and yet received the majority of the blame. The contractor may build his work in strict accordance with the specifications furnished and yet be blamed by the general public if the work is not satisfactory.

The mistakes of engineers are frequently shouldered by the contractor. The general public is a peculiar and fickle party to deal with. It is easily influenced and very seldom investigates carefully into the true merits of a case.

During the past year the writer had charge of a piece of work built by a contractor who was a stranger to him. Before the work had started he made inquiry of an engineer who had had some business dealings with the contractor as to his reputation. He reported that all he knew about the man was that he had built a job in his town that had not yet been accepted, and the general impression was that the work was improperly done. The writer found from his experience with this same contractor that he was strictly square and honest, and that his work was excellent. As a matter of curiosity he made an investigation of the piece of work that was the basis of the local engineer's opinion and found that the reason the work had not been accepted was because of a technical error in the legal proceedings involved. The legal talent should have shouldered the blame, yet the contractor in reality had thrust upon him an unsavory local reputation through no fault of his own.

There is a contractor of my acquaintance who so firmly believes that the contractor is ultimately blamed for the success or failure of a finished piece of work that he refuses to bid on work where the specifications do not meet with his approval. He claims that it has been his experience that the general public soon forgets the specifications and the engineer that made them, but that they do not forget the contractor. If the work is satisfactory, he gets the credit, and if it is unsatisfactory, he gets the blame. In so much as he depends upon his finished work for his reputation, he contends that he cannot afford to take any chances on questionable specifications.

He carries the point so far he will not bid on a pitch or asphalt filled brick pavement, because in his estimation, the only proper method to construct a brick pavement is with a cement grout filler.

Do not infer that the writer thinks that all contractors are perfectly honest, or that they should be classed as philanthropists. There are dishonest and crooked contractors, the same as there are dishonest men in other lines of business activity. All of them will bear watching, yet, the crooked and really dishonest contractor is the exception and not the rule.

We, as engineers, should be careful that our experiences with these exceptional cases do not prejudice us so that we impose unnecessary hardships and restrictions upon the men who are endeavoring to do good, conscientious work.

The contractor is a party to a contract the same as the state, county, or any other party of the first part, and is entitled to certain rights and privileges. He is not an undesirable citizen, or a necessary evil, but is a very necessary and important factor in the development of improvements of all kinds.

One of the most difficult problems confronting the engineer in the preparation of his specifications is that of making them rigid enough to control the refractory and bad contractor, and yet, at the same time, not handicap the man who is sincere and straightforward in his work.

The specifications should be drawn as to insure good and satisfactory work in every detail, and yet at a cost that is not excessive. If the cost were not a consideration it would be an easy matter to prepare specifications that would absolutely hold almost any contractor.

The cost, however, is a very important factor and must be carefully considered. Any unnecessary restrictions upon the work increases the cost to the contractor which, in turn, increases the cost to the party of the first part.

Time Limit Most Important

Many engineers and county superintendents fail to appreciate the effect that an extremely short specified period of time for the completion of a piece of work has upon the cost. In some cases the difference in cost might be small, yet, in general, it is considerable. Any time that you specify a time for completion so limited that it necessitates starting work immediately upon the awarding of the contract, you limit the competition to contractors who have outfits that are idle, or those that are willing to buy an outfit at hurry-up prices, in which case the increased cost is charged to the job. There are times in public, as well as private work, where the advantages of an early completion of a given piece of work more than offset any increased cost. As public officials, we must weigh all of these points, and if it is found to be good judgment to require special restrictions, provision for the added cost should be made in the estimate.

The engineer and the contractor, while representing two sides of a contract, should work with the same ultimate end in view, that is the completion of a satisfactory piece of work. Naturally, the contractor endeavors to secure this end with the least cost to himself. This tendency is not to be condemned, as it is simply a case of good business ability, unless carried to such an extent that it infringes upon the specifications and the quality of the work. If the latter case exists, the engineer must then exert the powers vested in him and see that the work is properly done.

An engineer may assist or retard a contractor in many ways. If he co-operates with him, the quality of the work, as a rule, is improved, for most contractors are human and appreciate this attitude on the part of the engineer. The party of the first part benefits not only in having a better finished product, but in future work; benefits in price, for when a contractor knows that the engineer is disposed to treat him fairly and not impose unnecessary hardships upon him, he is in a better position to figure closely on his job.

Some engineers assume the attitude that, if the work is not done properly they will not accept it and deliberately let the contractor go ahead and do things that are not in accordance with specifications, without making any effort to correct the faults. This method is to be condemned. Often infringements are the result of ignorance, and in such a case, failure of correction is an injustice to the contractor and poor business policy for the party of the first part. If the work is allowed to continue in an unsatisfactory manner to completion, one of two things is sure to happen, either the work is accepted or rejected. If accepted, the party of the first part is not getting what it is entitled to get, under the provisions of the contract. If it is rejected and the work torn out and replaced, the party of the first part is obliged to undergo delay and the inconvenience that always results from such conditions. A compromised job is rarely satisfactory to anybody concerned and on public work is food for gossip that is almost invariably grossly exaggerated, no matter how carefully and fairly the settlement was adjusted. Compromise settlements for inferior work have been made in the past and will, of necessity, be made in the future, but every effort should be made to avoid them. The occasion is rare when the contractor will deliberately disobey the instructions of the engineer. There are occasionally cases on public work where the contractor, through some political connections, or friendship, figures that he can override the engineer and secure an acceptance through what is commonly called "pull." Such occurrences were much more common in the past than they are at present, although there are yet some few contractors that are not educated up to this point.

The engineer should exert every effort to secure for the party of the first part, a satisfactory piece of work and all that can reasonably be expected under the specifications. He should not, however, abuse the powers vested in him to impose useless hardships upon the contractor. There are times where it becomes the duty of the engineer to protect the contractor from unjust demands, made by the party of the first part. An occasion of this kind happened in Henry county some three or four years ago. A bridge company had contracted to build a structure within a given period, which appeared to everybody concerned a very reasonable time. Work started very shortly after the contract was awarded. Quicksand was encountered in the footing, the river rose twice, flooding the cofferdams and the canal broke, cutting off, for the time being, transportation facilities for material. As a result of these unforeseen difficulties the work was not completed within the time limit required in the contract.. It was, however, completed in a very satisfactory manner and a big loss to the contractor, yet in spite of these facts the bridge committee endeavored to enforce a penalty on the contractor because the work was not completed within the specified time and produced a written opinion from a local attorney in which the claim was made that acts of God, labor difficulties, strikes, etc., afforded no excuse in the sight of the law for a contractor. It was the unpleasant duty of the writer to attempt to persuade this committee that they had no moral or legal right to the penalty, as the contractor had done everything in his power to complete the work and that, if they did withhold any of the money due the contractor they were actually stealing it. It is much easier, at such times, to follow the lines of least resistance and stay out of controversies of this kind, but a man does not deserve the name of engineer that has not the backbone to stand up for what he knows to be right, no matter whether he is acting in the interest of the contractor or the public.

The old saying, "If you don't expect to enforce the law take it off the statutes," holds good with a set of specifications and any instructions you may give to a contractor. Disobedience of one law breeds contempt for all law and the same is true as regards orders given to a contractor that are not enforced. Do not be arbitrary and do not give orders unless they are necessary, and then see that they are obeyed.

In starting a job give the contractor to understand exactly what you will expect of him and that you stand ready to assist him in any way possible to carry on his work in an efficient and economical manner, but that in turn you insist that he build the work as specified. Such an understanding, at the start of a job, will often obviate later controversies and insure a better finished product for, as a rule, the fewer the controversies the better the completed work.

Mainly Constructional

East and West—From Coast to Coast

Among the companies incorporated recently at Ottawa we note Thomas Kelly & Sons, Limited, of Winnipeg—and of Manitoba Parliament Buildings fame. The capital is stated as one million dollars.

The Montreal City Council is considering the project of building a 15-mile sewer from the north end of the city toward the east end of the island of Montreal, at an estimated cost of $1,000,000 to $2,000,000. It is recommended by Chief Engineer Mercier.

The Barr Clay Company, of Streator, Illinois, is the latest acquisition to the family of the Dunn Wire-Cut-Lug Brick Company's licensees. This is a company of the first importance in the Middle West and its standing both as to business methods and quality of brick is of the highest.

A company has been newly incorporated at Russell, Ont., with a capital stock of two hundred and fifty thousand dollars, under the name of Russell Fire Proofing, Limited. The company purposes the manufacture of clay products. Among the incorporators are Andrew Walker, H. Kennedy and J. A. Cochrane.

E. T. Ramsay, Limited, is the name of a company newly incorporated at Montreal with a capital stock of fifty thousand dollars, to carry on the business of manufacturing all kinds of building materials and contractors' supplies. Among the incorporators are H. S. Thompson, J. A. LaBrecque, J. E. Campbell, and J. LaBrecque.

The Manitoba Norris Government has contracted with the Canadian Appraisal Company, of Montreal, to make a complete appraisal of the public buildings in the province, and the provincial telephone system, the work to be finished within sixty days. This is the first step in a departmental investigation of the erection of every public building in Manitoba.

The municipality of St. Hilaire, P. Q., have let a contract to the Century Electric Company, Montreal, for installing a distribution system for street and house lighting and for power. The system will cover an area of 3½ miles. The transmission line will be on wooden poles 35 feet high, and nitrogen-filled lamps will be used for street lighting. A small sub-station will be constructed. Eight tenders were submitted.

For the purpose of constructing the St. Maurice River dam, designed by the Quebec Streams Commission, the St. Maurice Construction Company, Limited, the contractors, are installing a hydro-electric plant of 1,150 horse power, consisting of two units of 575 h.p. each. The power will be developed under 15 feet head. The S. Morgan Smith Company will supply the turbines and the Canadian Westinghouse Company the generators.

The name which has been officially given to the site of the future 250,000,000 gallon reservoir thirteen miles east of the city of Winnipeg, for the storage of the water to be brought from Shoal Lake, will testify for all time to come to the important part taken by Mr. T. R. Deacon, twice elected by the citizens of Winnipeg to be their chief magistrate, in initiating the Greater Winnipeg Water District undertaking. Deacon is at present the material yard of the District and the headquarters of the District railway, as well as the engineering headquarters for the construction of the western end of the aqueduct.

The new Government grain elevator at Calgary is now finished and ready for use. This completes the chain of international elevators built by the Government between the Great Lakes and the Rockies, those at Moose Jaw and Saskatoon being already in operation. All these elevators, including the one at Port Arthur, will be available for handling this season's crop. The Vancouver elevator, with a capacity of a million bushels, is being rushed to completion. The new Government grain elevator in Calgary has a capacity of 3,000,000 bushels. It is constructed of reinforced concrete and cost a million dollars.

At a meeting of the Quebec Public Utilities Commission held in Montreal, the question as to separate conduits for electrical wires was again discussed. The Electrical Service Commission propose to place all wires of the various Montreal public utilities (except those of very high voltage) in the same conduits, while it was argued that this was likely to lead to damage, and that separate conduits for low tension cables and for higher tension cables should be built. Under the city charter these companies requesting separate conduits will have to pay for them; against this it was stated that the Public Service Comporation, which raised the question, did not ask for separate conduits. It was for the Utilities Commission to decide as to whether it was desirable to build the separate conduits, on the ground of safety, and if so the city should bear the cost. The Commission will give their decision later.

A plant to cost $100,000,000 and generate 2,000,000 h.p. of electric energy is included in a plan for the utilization of the waters of the lower Niagara river presented to the New York State authorities of Ontario of the Dominion of Canada. The project is to dam the Niagara river just above Queenston, Ont., and Lewiston, N. Y., the dam to be 90 feet high and forming a small Niagara of its own. This would impound the river back to within a mile of the falls and wipe out the famous Whirlpool Rapids. One million horse-power of the new development would go to New York and a similar amount to Ontario. Aside from the project of Sir Adam Beck to dam the St. Lawrence and develop three million horse-power of energy, this is the most ambitious hydro-electric project yet put forth. To carry it into effect would require joint action on the part of Ontario and New York state and also new treaty arrangements between the United States and the Dominion of Canada.

It is learned on good authority that P. Lyall and Sons Construction Company, Limited, which is producing shells on an order for 4.5 high explosives, is arranging its organization at the Westmount shops to bring the output of these shops up to 1,000 per day. The plant for the machining of these shells has been installed and production at the rate of 1,000 per day is expected to be reached within a month or six weeks. Shipments have been going forward for the past week or so. The company has also a contract for forging the shell cases from the steel round as well as machining. Machinery for this work is now being installed and the forging plant is expected to be in operation within a short time. The company has practically completed about $3,000,000 of the building contracts which it had on its books at the beginning of the year, leaving it comparatively free to concentrate on this new shell business and on the building of the Union Station at Toronto, when that is finally started.

There was keen competition for the contract to build the dam on the St. Francis River, P. Q., plans for which were drawn up under the direction of Mr. O. Lefebvre, Chief Engineer of the Quebec Streams Commission. The dam will store water from a drainage area of 472 square miles, and will be of the hollow concrete type. It will increase the water supply of several hydro-electric plants on the river. The bids varied from $186,736 to $101,027, the latter being from Mr. George Madden, of Quebec, who has been awarded the contract. The other tenderers were: Bates & Rogers Construction Company, Chicago, $176,000; O'Brien & Doheney, Montreal, $148,350; L. A. Ott & Company, Montreal. $122,561; Laganiere, Houde & Company, Grondines, $147,665: Joseph Gosselin, Levis, $118,870; The Provincial Building & Engineering Company, Montreal, $120,014; Julien Toussaint & Company, Ltd., Montreal, $124,000; Arsenault & Plamondon, Montreal, $117,468; Cloutier, Trudel & Coulombe, St. Romuald, $129,437; O'Connor Brothers, Huntingdon, $109,280; Atlas Construction Company, Montreal, $113,750; Nova Scotia Construction Company, Sydney, N. S., $151,333; Galbraith & Cate, Limited, Montreal, $105,500; Paquette & Godbout, St. Hyacinthe, Que., $163,175; Ambursen Hydraulic Construction Company, Montreal, $186,736; Thomas O'Sullivan, Montreal, $124,200. This makes a total of seventeen bids.

Personal Mention

R. Howting, a Brantford contractor, dropped dead last week a short distance from his home.

Mr. Robert J. Lecky, head of the engineering and general contracting firm of Regina, has been in Toronto attending the General Synod of the Anglican Church.

Major Stuart Howard, late head of the sewers department of the city of Montreal, has been appointed to the command of the Royal Canadian Engineers, 4th Division.

Harry Braithwaite Abbott, C. E., well known as the first General Superintendent of the Canadian Pacific Railway at Vancouver, and one of the most successful engineers in Canada, died recently after a brief illness, at the age of 86. He was a younger brother of the late Sir John Abbott, K.C.M.G., third Prime Minister of Canada.

The death of Sir William Van Horne, the former head of the Canadian Pacific Railway, cannot be allowed to pass without brief record in these columns. Sir William was born at Jolliette, in Illinois, in 1843. At the age of fourteen he became an office boy at the railway station in his native town. There he acquired a knowledge of telegraphy, which procured him employment as a telegraph operator with the Illinois Central Railway. With this line and others he passed through the various grades of telegraph operator, ticket agent, train despatcher, superintendent of telegraphs, and divisional superintendent. In 1872 he became General Superintendent of the St. Louis, Kansas City and Northern Railway, which was at that time in the hands of the Receiver, and which he made a paying concern. In 1880 Mr. Van Horne—as he was then—accepted the office of General Superintendent of the Chicago, Milwaukee and St. Paul Railway —then the most extensive system in the United States. Rather more than a year later he resigned to become General Manager of the Canadian Pacific Railway. Under Van Horne's direction the building of the C. P. R. progressed with such extraordinary rapidity that the main line was completed in fifty-four months—less than half the time allowed by the contract between the company and the Government. Mr. Van Horne succeeded Duncan McIntyre as Vice-President in 1884; he became President in 1888, on the retirement of Lord MountStephen, and Chairman of the Board of Directors in 1899. He remained Chairman of the Board until 1910, and was a member of that body until his death. He was created a Knight of St. Michael and St. George by Queen Victoria in 1894.

Pro Patria

THE subject of our sketch this week is Capt. Duguid, formerly Superintendent of the plant of the Imperial Steel and Wire Company, Limited, of Collingwood, manufacturers of wire and wire products. Capt. Duguid was born in Toronto thirty-six years ago. He attended the Public Schools and the Harbord Collegiate Institute in that city, and was largely instrumental in the organization of the Harbord Cadet Corps, of which he was the first Captain. When the Boer War broke out, in 1899, he was among the first to offer his services and to go to the front—at the early age of twenty. At the termination of hostilities in South Africa he returned to Canada, and in 1902 went to Collingwood to take a position with the Cramp Steel Company. In 1905 he accepted the post of Superintendent of the Imperial Steel and Wire Company's plant—a position he held in August, 1914, when he offered his services in the present war. Capt. Duguid was given a Captaincy in the 48th Highlanders of Toronto (15th Battalion), and later was made Quartermaster of the Battalion—a position which he still occupies. He has been with the Battalion continuously since his enlistment, and according to what is known at present has come unscathed through the battles of St. Julien, Festubert, and other engagements.

Captain Duguid.

The Novitiate which is being erected at Laval des Rapids, Que., by the Christian Brothers, at a cost of $475,000, has reached the roofing stage. The building is five storeys high, of steel and brick construction. The architects are Messrs. Viau & Venne, of Montreal, and the general contractors Messrs. E. N. & W. Boileau.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Bertie Township, Ont.
The Township Council have authorized the laying of a granolithic sidewalk on North Ridge Street. Clerk, M. S. Pound, Ridgeway, Ont.

The Township Council propose to complete the Gilmour Road extension,—a length of about one mile. Engineer, L. A. Kinnear, Port Colborne.

Brockville, Ont.
The Town Council are considering the construction of a quantity of tarvia paving, curbing, etc., estimated to cost $14,000, and of a sewer on Edgewood Avenue. Engineer, G. H. Bryson.

Chatham, Ont.
The Town Council intend to construct a concrete pavement on Prince Street and granolithic sidewalks on Violet and Inches Streets. Engineer, F. P. Adams.

The City Council have decided to lay a concrete pavement on Louise Street. Engineer, F. P. Adams.

Coaticook, Que.
The Town Council have passed a by-law for the gravelling of South and Compton Streets and Ladds Mills Road. Engineer, E. E. Akhurst.

Digby, N.S.
Tenders on the construction of 174 concrete and pipe culverts are being received by E. H. Armstrong, Minister of Roads and Mines, Halifax. Plans and specifications at the Department, Halifax.

Dorval, Que.
The Marcil Trust Company, Limited, 180 St. James Street, Montreal, are about to lay watermains and sewers on a number of streets and to construct a quantity of concrete sidewalks.

East Angus, Que.
Work is about to start on the construction of extensions to the waterworks system, estimated to cost $5,000. Town Clerk, R. C. Cowling.

Fullarton Township, Ont.
Tenders will be received until 2.30 p.m., September 24th, by the Township Clerk, R. H. Pomeroy, Fullarton, for the construction of the Goforth Drain. Plans and specifications at office of John Rogers, Mitchell.

Guelph, Ont.
The City Council have authorized the construction of sewers on Beverly, Harris, Johnson and Prospect Streets. Approximate cost, $5,188. Engineer, F. McArthur.

Harwich Township, Ont.
The Township Council contemplate building a road from Bisnett side road across the rear of Erie Beach to the Town Line. Clerk, G. W. Riseborough, Blenheim, Ont.

Kingston, Ont.
The construction of macadam roads and concrete sidewalks on a number of streets is being considered by the City Council. Clerk, W. W. Sands.

Lachine, Que.
The Marcil Trust Company, Limited, 180 St. James Street, Montreal, are laying concrete sidewalks on their property on 53rd Avenue.

New Toronto, Ont.
Tenders will be received until noon, October 1st, by J. A. Telfer, Clerk of Mimico, for the following works:—(1) sewers and watermains; (2) sewage disposal works; (3) supply of sanitary vitrified pipes; (4) sewage pumping station. Plans and specifications at office of the Engineer, T. Lowes, 186 King Street W., Toronto.

Owen Sound, Ont.
The Town Council have authorized a $16,000 debenture issue to cover the cost of waterworks extensions. Work will include an 8-inch high pressure main from Eighth Street to the west side factory district. Clerk, Charles Gordon.

The Town Council intend to construct a high pressure waterworks system this fall by day labor. Approximate cost, $7,000. Engineer, Robert McDowall.

Sandwich, Ont.
The Town Council are considering a proposal for the construction of an esplanade one-third of a mile long, on the Canadian bank of the Detroit River. Clerk, E. R. North.

Sherbrooke, Que.
A number of sewers and concrete sidewalks are being built by day labor under supervision of the Road Superintendent. Engineer, Thomas Tremblay.

Stamford Township, Ont.
Work by day labor has been started on the construction of a quantity of water-bound macadam roadway for the Township Council. Approximate cost, $28,000. Engineer, J. C. Gardner, Queen Street, Niagara Falls.

The Pas, Man.
Tenders on the following work will be received until 2 p.m., October 12th, by the Town Clerk, H. H. Elliott:—(1) Trenching and laying cast iron or steel watermains: (2) supply and delivery of cast iron or steel water pipes and specials; (3) supply and delivery of fire hydrants and valves; (4) supply and delivery of vitrified sewer pipes, trenching and laying. Plans and specifications at office of the Consulting Engineers, Murphy & Underwood, 8 Bottomley Block, Saskatoon, Sask., the Resident Engineer, The Pas, or of the Contract Record, Toronto and Winnipeg.

Toronto, Ont.
The Board of Control will receive tenders until October 12th for the supply of 36-inch stop valves, valve operating mechanism and special castings for the Main Pumping Station. Commissioner of Works, R. C. Harris, City Hall.

The contract for the construction of a sewer on Russell Hill Road and St. Clair Avenue has been transferred from the Commissioner of Works to Tussell McReynolds Company, 366 Keele Street, at $475,000.

Commissioner of Works R. C. Harris is preparing a report on the cost of extending the 6-inch watermain from the City Limits to King Edward Sanitarium, Mount Dennis. Approximate cost, $40,000.

The Board of Control will receive tenders until September 28th for the construction of asphalt, asphaltic concrete, brick block and bitulithic pavements on a number of streets and a quantity of concrete sidewalk. Plans at office of the Works Department, City Hall.

Victoria, B.C.
The City Council have decided to construct a sewer on King's Road between Cedar Hill Road and Mount Steven St. Engineer, C. H. Rust.

Winnipeg, Man.
The Board of Control are considering the extension of the watermain on Centennial Avenue to the West City Limits. Estimated cost, $5,000. Engineer, W. P. Brereton, 223 James Avenue.

CONTRACTS AWARDED

Aldboro Township, Ont.
D. D. Campbell, Rodney, Ont., has been awarded a contract by the Township Council for the construction of tile drains, and is in the market for about 5,000 feet of 12-inch tile.

Niagara Falls, Ont.
Thomas & McPherson, Niagara Falls, are laying sidewalks and curbing for the Town Council. Estimated cost, $8,000.

Norfolk County, Ont.
The County Council have let the contract for the erection of a reinforced concrete retaining wall to J. W. Mills, South Middleton.

Perth, Ont.
Work has been started on the construction of a filter system for the Canadian Electric & Water Power Company, by the Robert Filters Manufacturing Company, Philadelphia, Pa. Cast iron pipe and specials will be purchased by the Electric Company's Engineer, R. J. Smith. Approximate cost, $15,000.

Rosthern, Sask.
Work has been commenced on the construction of three cement cisterns for the Town Council. Contractors, Gan-

zeini Bros., Rosthern. Approximate cost, $7,000.

Simcoe, Ont.
Work is about to start on the construction of a concrete roadway on Colborne Street for the Town Council. The contract has been awarded to the Maple Leaf Artificial Stone Paving Company, Simcoe, at $1.45 per square yard.

Toronto, Ont.
The Board of Control have let the following contracts:—asphalt pavements on Laughton and Uxbridge Streets, Contracting & Paving Company, Limited, Confederation Life Building, at $9,946; rocmac macadam on Innes Avenue, Asphaltic Concrete Company, Limited, 74 King Street E., at $3,126; asphalt pavement on Ilford and Talbot Streets and Indian Road, Commissioner of Works R. C. Harris, at $13,058; sewers on Ivy, Lambert and Rockwell Streets, Routly & Summers, 47 Sparkhill Avenue, at $3,854; sewers on Golfview Avenue, Longo & Gentile, 663 Markham Street.

The Board of Control have let contracts for the construction of sidewalks to the following firms:—H. Mitchell, 1156a College Street; Riverdale Concrete Paving Company, 256 Jones Avenue; Routly & Summers, 47 Sparkhill Avenue; Grant Contracting Company, 50 Front Street E.; Gardner & Company, Goodyear Building; International Contracting Company, 226½ Yonge Street; A. J. Penberthy, 292 Booth Avenue; R. J. Moyes & Company, 592 Gerrard Street E.; Britnell Contracting Company, 209 Davenport Road; and the Commissioner of Works, R. C. Harris, City Hall.

Railroads, Bridges and Wharves

Durham and Northumberland Counties, Ont.
The Ontario Hydro-electric Commission have been petitioned by the Muncipalities in these counties to report on the advisability of constructing an electric railway to run from Peterborough through Campbellford, Seymour, Percy, Alnwick, Haldimand and Hamilton Townships to Coburg.

Harwich Township, Ont.
The Township Council have asked the Provincial Hydro Electric Commission to submit an estimate of the cost of an electric railway between Blenheim and Cedar Springs. Clerk, G. W. Riseborough, Blenheim, Ont.

Nova Scotia Province
The Provincial Department of Roads and Mines, Halifax, intend to construct a number of concrete and steel bridges. Cement, concrete machinery and lumber will be purchased. Minister, E. H. Armstrong, Halifax.

CONTRACTS AWARDED

Dover Township, Ont.
The Township Council have let a contract for the construction of three concrete and steel bridges to John Tewkesbury, 224 Lacroix Street, Chatham, at $3,000.

North Gwillimbury, Ont.
The Township Council have let the contract for the steel superstructure of a bridge to the Chatham Bridge Company, Chatham, and for the concrete abutments to John Ritchie, Beamsville. Approximate cost, $4,500.

Nova Scotia Province
The Provincial Department of Roads and Mines, Halifax, have let the contract for the erection of a steel and concrete bridge in Yarmouth County to Thomas Rawding, Main Street, Liverpool, N.S.

St. John, N.B.
The contract for the dismantling of the Old Suspension Bridge has been let by the Department of Public Works, Fredericton, to Joseph McVay & Sons, Rushton Street, St. Stephen, N. B., at approximately $23,000.

Stamford Township, Que.
The general contract for the construction of a steel and concrete bridge over the White River for the Municipal Council has been awarded to Auguste Quesnel, Arthabaska, Que. ... ...

Public Buildings, Churches and Schools

Cardston, Alta.
The Trustees of School District No. 457 have been authorized to borrow $50,000 for the erection and equipment of a school. Treasurer, James W. Low, Cardston.

Fort William, Ont.
Tenders for heating, plumbing and wiring at the Registry Office will be received until September 30th by the Provincial Department of Public Works, Parliament Buildings, Toronto. Plans at office of George A. Eoll, Fort William, and at the Department. Estimated cost, $28,000.

Orillia, Ont.
Tenders on the erection of a Municipal Building and Opera House will be received until September 27th by the Architects, Burke, Horwood & White, Ryrie Building, Toronto. Brick, concrete and steel construction, metal roofing. Plans and specifications at office of the Architects. Approximate cost, $30,000.

Sault Ste. Marie, Ont.
The Department of Public Works, Parliament Buildings, Toronto, will receive tenders until October 7th, for heating, plumbing and wiring at the Jail. Plans at office of the Sheriff and at the Department. Approximate cost, $29,000.

Toronto, Ont.
Tenders will be called shortly for additions and alterations to Bellefair Methodist Church, Queen and Bellefair Avenue. William Alvey, 2349 Queen Street E., and W. Harrison, 82 Wheeler Avenue, are members of the Building Committee.

Trenton, Ont.
Work has been started by day labor on alterations to Grace Methodist Church. Brick construction. Approximate cost, $5,000.

CONTRACTS AWARDED

Ford City, Ont.
The general, roofing, plastering and painting contracts for alterations to the Roman Catholic Presbytery have been let to Euclid Jacques, 87 Assumption Street, Windsor, the masonry contract to Cross Bros., 25 Louis Avenue, Windsor, the contract for heating and plumbing to Fred L'Heureux and for electrical work to W. Lefave, 225 Bruce Avenue, Windsor. Approximate cost, $6,000.

Granby, Que.
The general contract for the erection of a Municipal Building for the Township Council has been let to T. Delorme, Granby. Approximate cost, $6,500.

Leclercville, Que.
The contract for the erection of a school has been let to Ernest Daigle, St. Emelie, Que. Brick construction. Approximate cost, $7,000.

Middlechurch, Man.
The contract for plastering in connection with the addition being erected at the Old Folks Home has been let to the general contractors, S. Brynjolfsson & Company, 506 Builders Exchange Building, Winnipeg.

North Portal, Sask.
The Trustees of the Minto School District No. 490 have let the contract for the erection of a brick school to H. E. McKenzie Company, Fourth Avenue, Estevan. Estimated cost, $6,000.

Peterborough, Ont.
The general contract for alterations to the Y. M. C. A. Building at 475 George Street has been let to James Rose, R. R. No. 6, Peterborough, at $7,000.

St. Louis Gilbert, Man.
In connection with the school now in course of erection for the Wakefield School District, the masonry, carpentry, steelwork and roofing contracts have been let to the general contractors, Simmons Bros., 1200 Garfield Street, Winnipeg, the contract for painting to A. Tackman, 542 Flora Avenue, Winnipeg, and for heating to A. Christie, 521 Henry Avenue, Winnipeg.

Tavistock, Ont.
The carpentry contract in connection with the Library now being built has been let to F. Kalbfleisch, Hope Street, the plumbing contract to George Eifert, and the heating contract to Woefle & Son, Woodstock Road.

Business Buildings and Industrial Plants

Brighton, Ont.
The foundry now being built for the D. J. Barker Foundry Company, Limited, is to be of brick construction with concrete foundations. Approximate cost, $13,000.

Calgary, Alta.
The erection of a flour mill is contemplated by the Alberta Flour Mills, Limited. Arthur T. Seyler, publisher, Thomas M. Ovens, Fred Kennedy and H. H. Farmer, all of Calgary, are interested.

Chilliwack, B.C.
The Canadian Northern Railway are building a station. Frame construction. Work is being done by the company's engineering staff.

Eustis, Que.
The Eustis Mining Company are preparing to rebuild their mill, which was recently destroyed by fire. Work will be done partly by contract and partly by day labor. Estimated cost, $75,000 to $100,000.

Hope, B.C.
A station is being erected by the engineering staff of the Canadian Northern Railway. Head Office of the Company, 1 Toronto Street, Toronto.

Lac Megantic, Que.
P. H. Renaud, Agnes Street, is about to rebuild his pulp mill by day labor. Machinery will be purchased, but will not be required until April, 1916.

Matsqui, B.C.
T. Z. Smith, Matsqui, is considering the erection of a box factory.

Montreal, Que.
Tenders on repairs to the garage and stores at 660-670 St. Catherine Street W. are now being received by George Caverhill, 89 St. Peter Street. Estimated cost, $8,000.

The addition to the premises of the Union Brewery, Limited, 592 Cadieux Street, is being built by day labor. Architect, L. A. Amos, 78 Crescent Street.

The erection of a restaurant at St. Catherine and Peel Streets is being considered by Walton's Lunch, 259 St. James Street. Architect, W. C. Collette, 50 Broomfield Street, Boston, Mass.

Murray Bay, Que.
Plans are being prepared for repairs and fireproofing at the Manoir Richelieu, and tenders will be called shortly. Owners, Canada Steamship Lines, Limited, Victoria Square, Montreal.

Pembroke, Ont.
Work will start at once on the rebuilding of an ice house and stable for T. A. Sammon, Copeland House. Brick and cement will be required.

Quebec, Que.
The erection of a picture theatre on St. John Street is being considered by J. M. E. Bedard, Grand Allee Gardens, Quebec. Fireproof construction.

Toronto, Ont.
Plans have been prepared by J. M. Cowan, 65 Adelaide Street E., for a coal storage shed to be erected at Bloor and Perth Streets for J. Muldoon, Limited, 1191 Queen Street W. Frame and iron construction. Material will be purchased by the owners.

N. H. Murphy, 84 Dominion Street, is receiving tenders on the erection of a garage. Brick construction.

Welland, Ont.
J. R. Sidey contemplates remodelling a business block on East Main Street.

Wiarton, Ont.
Tenders on the framing and erection of a barn will be received until September 30th by William Dinniwell, R. R. No. 3, Wiarton.

CONTRACTS AWARDED

Cote St. Paul, Que.
The following contracts have been let in connection with the branch building in course of erection at Church and Hadley Streets for Molsons Bank:—mill work, N. Sarrasin & Fils, Limited, 228 Duvernay Street, Montreal; roofing, Richardson, Simard & Company, 715 Clarke Street, Montreal; marble and tile work, James Walker Hardware Company, Limited, St. James St., Montreal.

Hamilton, Ont.
J. Stroud has let the contract for the installation of a passenger elevator at the Hotel at Merrich and McNab Streets to A. Bresett & Company, 58 Peter St.

The following contracts have been let for the erection of a factory on King William Street for Laing & Sons, 28 McNab Street S.:—masonry, R. Tope, 191 Robinson Street; carpentry, G. Bell, 208 Holton Avenue S.; steelwork, Hamilton Steel Construction Company, Lottridge Street. Roofing, painting, heating, plumbing and electrical work not let.

Levis, Que.
The contract for roofing the freight sheds now being built for the Intercolonial Railway has been let to J. Dunphy, 55 Barrie Street, Montreal.

Montreal, Que.
The sub-contract for steelwork in connection with the wagon shed to be erected for the Imperial Oil Company, Limited, 918 St. Patrick Street, has been let to Structural Steel Company, Limited, 10 Cathcart Street.

In connection with the garage being built at 100 Ottawa Street for the Montreal Light, Heat & Power Company, the contract for heating and plumbing has been let to Hart & O'Brien, 759 St. Antoine Street, the contract for metal sash to Steel & Radiation, Limited, 304 University Street, and for the installation of an elevator to Darling Bros., 120 Prince Street.

Niagara Falls South, Ont.
W. E. McCredie, 66 Barker Street, is building a barn for B. R. Payne. Frame construction, cement foundation. Approximate cost, $4,000.

Ottawa, Ont.
The contract for heating and plumbing in connection with alterations to a store for R. E. Powell, 290 Elgin Street, has been let to McKinley & Northwood, Rideau Street.

W. D. Morris, Somerset and Emmett Streets, contemplates the construction of an oil storage plant, and has let the contract for tanks to the Campbell Iron & Steel Works, Carling Avenue. The building will probably be of brick construction.

In connection with the stores being erected on Bank Street by W. H. Lister, et al, 127 Second Avenue, the plumbing contract has been let to J. D. Gervin, Bank and Sunnyside Streets.

The contract for the erection of a garage for John R. Brown, MacLaren St., has been let to Garnet Douglas, 382 Waverley Street. Frame, stucco and brick veneer construction, concrete foundation, felt and gravel roofing.

Port Arthur, Ont.
In connection with the grain elevator now being erected at Third Avenue and King Street for the National Elevator Company, Limited, the general, carpentry and heating contracts have been awarded to Barnett & McQueen, Christina Street, and the electrical work to the Western Electric Company, 708 Victoria Street, Fort William.

Preston, Ont.
Work is progressing on the erection of a warehouse for Jacob Werlich, Shantz Block. The contract for brickwork has been let to Wirsching Bros., Preston, and for carpentry to Norman Hipel, Waterloo Street.

Stratford, Ont.
The contract for roofing the City Hall has been let to Pounder Bros., 21 Downie Street.

Strathroy, Ont.
Work is about to start on the erection of a wooden silo for S. Oakes. The contract has been let to John Smith, Strathroy.

Toronto, Ont.
The H. J. St. Clair Company, Limited, 69 Yonge Street Arcade, have been awarded a contract for store fronts and other work at 406 Yonge Street for the W. Long Piano Company, 264 Queen Street W. Contract for painting and decorating not yet awarded.

Whitby, Ont.
In connection with alterations and additions to the school, the contracts for roofing, plastering and painting have been let to the general contractor, Joseph Pearson, Whitby, and for electrical work to C. M. Stevens, Whitby.

Windsor, Ont.
In connection with alterations to a store on Sandwich Street W., for W. C. Kennedy, the heating contract has been let to J. L'Heureux, and the contract for installation of an elevator to the Roelofson Elevator Works, First Avenue, Galt.

Winnipeg, Man.
Work has been commenced on the erection of a milk depot on Aberdeen Street for the Board of Control. The masonry and carpentry contracts have been let to the general contractors, Simmons Bros., 1200 Garfield Street, the contracts for roofing and heating to Christie Bros., Henry Avenue, and for painting to A. Lackman, Flora Avenue.

Residences

Aurora, Ont.
M. Shulman contemplates the erection of a residence, estimated to cost $5,000. Brick construction.

Charlottetown, P. E. I.
Tenders on the erection of a residence for Russel White, Brighton Street, are being received by Chappell & Hunter, DesBrisay Block. Frame construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Hebron, N. S.
The residence of Knowles E. Crosby, recently destroyed by fire, will be rebuilt in the spring.

Lachine, Que.
Work has been started by O. Belanger, 60 Sixth Avenue, on the erection of five flats on St. Joseph Street. Brick encased construction, concrete foundation, felt and gravel roofing. Estimated cost, $7,000.

Montreal, Que.
Work has been started on the erection of a residence for A. Cloutier, 810 Durocher Street. Estimated cost, $3,000.

J. P. Daoust, 468 Prud'homme Ave., has commenced the erection of two residences on Marcil Avenue. Estimated cost, $4,000.

(Continued on page 53)

Tenders and For Sale Department

Tender No. 68

For the Construction and Delivery of

36 Inch Stop Valves, Valve Operating Mechanism and Special Castings for Main Pumping Station

Tenders will be received through registered post only, up to noon on **Tuesday, October 12th, 1915**, for the construction and delivery of—

36 Inch Stop Valves, Valve Operating Mechanism and Special Castings for Main Pumping Station

Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto, and be plainly marked on the outside of envelope as to contents.

Specifications and forms of tender may be obtained at the Works Department, City Hall.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.
Toronto, September 13th, 1915. 38

To Contractors

Tenders addressed to the undersigned will be received at this Department until **Thursday, Sept. 30**, for Heating, Plumbing and Electric Wiring of the Registry Office, Fort William. Plans and specifications can be seen at the office of Geo. A. Eoll, Fort William, and at this Department. Also for the Heating, Plumbing and Electric Wiring of the Gaol Building, Sault Ste. Marie, until **Oct. 7.** Plans and specifications can be seen on and after Sept. 22 in the Sheriff's Office, Sault Ste. Marie, and at this Department. Each tender must be accompanied by an accepted bank cheque, payable to the Honorable F. G. Macdiarmid, Minister of Public Works, Ontario, for 5 per cent. of the amount of the tender, and the amount will be forfeited if the person or persons tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for; and the bona fide signatures and addresses of two sureties or the name of a guaranty company, approved by this Department, willing to provide bond for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By Order,

H. F. MACNAUGHTEN,
Secretary, Public Works Dept.
Department of Public Works, Ontario, Toronto, Sept. 16, 1915.

Newspapers publishing this without authority will not be paid for it. 38

Contractors Plant For Sale

The Corporation of the City of Victoria, B. C., have a large quantity of contractors' plant for sale, consisting of dinkey engines, dump cars, about 450 tons of 20-lb. rail, hand cars, hoisting engine, pipe, etc. A complete list of the above equipment, and any further information may be obtained upon application to the office of the City Purchasing Agent, City Hall, Victoria, B. C.

Victoria, B.C., August 27th, 1915. 36-38

Tenders for Sewerage and Water Supply

The municipalities of Mimico and New Toronto are prepared to receive tenders for the following works:—

Contract No. 1.—Sewers and Water Mains.

Contract No. 2.—Sewage Disposal Works.

Contract No. 3.—Supply of Sanitary Vitrified Pipes.

Contract No. 4.—Sewage Pumping Station.

Quantities and notice to bidders may be obtained and specifications and plans examined at the office of the Engineer, T. Lowes, 186 King Street West, Toronto.

The Engineer will attend at 10 a.m., Tuesday, the 21st inst., at stop 12, Mimico, to meet intending bidders and show them over the ground.

Tenders to be sent in not later than noon, **Friday, the 1st of October next**, sealed and addressed to J. A. Telfer, Clerk to the Municipality, Mimico, Ont.

C. COXHEAD, Reeve, Mimico.
G. IRONSIDE, Reeve, New Toronto.
September 15th, 1915. 37

The Pas, Manitoba

Water and Sewer Extensions

Sealed tenders will be received by the undersigned, Town Clerk of the Town of The Pas, up to 2 p.m., **October 12, 1915**, for the following works:—

Tender A.—Trenching and laying cast iron or steel water mains.

Tender B.—Supply and delivery of cast iron or steel water pipes and specials.

Tender C.—Supply and delivery of fire hydrants and valves.

Tender D.—Supply and delivery of vitrified sewer pipe, trenching and laying of same.

Plans and specifications may be seen at the office of the Engineers, Saskatoon, Sask., the Resident Engineer's office, The Pas, Manitoba, or the Contract Record's office, Toronto and Winnipeg.

The lowest or any tender not necessarily accepted.

H. H. ELLIOTT, M.D., Town Clerk,
The Pas, Man.
MURPHY & UNDERWOOD,
Consulting Engineers,
38-40 Saskatoon, Sask.

Department of the Naval Service

Tenders for Miscellaneous Material

Sealed tenders, addressed to the Undersigned, will be received up to noon on **Tuesday, October the 19th**, for the undermentioned items for delivery to **H. M. C.** Dockyards at Halifax, N. S., and Esquimalt, B. C.

Brass Bars
Brass Sheets
Brass Tubes
Copper Sheet
Copper Tubes
Zinc Plates
Lead, milled or sheet
Antimony
Aluminum
Steel Angles
Steel Boltstaves
Steel Plates
Steel Sheets
Steel for Tools
Iron Firebar
Iron, pig
Iron angles
Iron Boltstaves
Iron Sheets
India Rubber Sheet packing, etc.

Forms of tender and all information may be obtained by application to the Undersigned or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C.

Applicants for forms are requested to state definitely the item or items on which they desire to tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service,
Ottawa, September 11th, 1915.

Unauthorized publication of this advertisement will not be paid for.—S5276. 38-39

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electrical Equipment, Printing Bureau, Ottawa, Ont.," will be received at this office until 4 p.m., on **Tuesday, September 28, 1915**, for one (1) motor generator set, one (1) induction motor, three (3) power transformers and switch board apparatus to be delivered at the Government Printing Bureau, Ottawa, Ont.

Specifications and forms of contract can be seen and forms of tender obtained at this Department, and at the offices of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. R. L. Deschamps, Superintendent of Public Buildings, Mohtreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honorable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, September 20, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—S5492. 38

TOWN OF DRUMMONDVILLE

Tenders Wanted

Tenders will be received by the Town Clerk of the town of Drummondville, up to the **1st of October at 7 o'clock p.m.**, for the construction of a steel or concrete bridge, 52 feet span, in the town of Drummondville.

Each tenderer to supply his own plans, specifications, etc.

The lowest or any tender not necessarily accepted.

W. A. MOISAN,
Town Clerk.
Drummondville, Sept. 18th, 1915. 38

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, October 1st, 1915
for

Temperature Regulators, Sundry Schools

Cabinet Work, including Work Benches, Tables, Cupboards, etc., for Manual Training and Domestic Science Centres.

Concrete Retaining Wall, Roden School

Local Telephones, Sundry Schools

Electrical Work for Science Rooms, Harbord Street and Malvern Ave. Collegiate Institutes

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for 5 per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
Secretary-Treasurer.
MILES VOKES,
Chairman of Committee.
38

Residences

(Continued from page 51)

T. Benoit, Fifteenth Avenue, has commenced the erection of two flats, estimated to cost $3,000. Concrete construction, felt and gravel roofing.

Work on the erection of two residences has been started by A. Blanchet, 2227 Gouin Boulevard. Approximate cost, $4,000.

Louis Corbeil, 1083 Mount Royal Ave., has commenced the erection of six residences on Demontigny Street E. Approximate cost, $6,000.

Niagara Falls, Ont.

Work has been started by William Henry, Second Street, on the erection of a residence on McRae Street, estimated to cost $3,500. Brick veneer construction, concrete foundation, shingle roofing. Contracts will be let for heating, plumbing and electrical work.

H. G. Scott, 215 Victoria Avenue, is building a residence estimated to cost $3,500 and has started work on another to cost about $4,000. Frame construction, concrete foundation, shingle roofing. Contracts will be let for heating, plumbing and electrical work.

Ottawa, Ont.

Herbert Cotter, 80 Vaughan Street, contemplates the erection of a residence on Electric Street, at an estimated cost of $4,200. Painting, heating, plumbing and electrical work will probably be sublet. Double brick veneer construction, felt and gravel roofing.

J. W. Foster, 11 Irving Avenue, is building a residence on Sherbrook St., estimated to cost $3,500. Brick veneer construction, felt and gravel roofing.

James H. Saunders, Desmond Apartments, Gloucester Street, has prepared plans for a residence to be built on Centre Street at an approximate cost of $5,500. Stucco and brick veneer construction, stone foundation, shingle roofing.

McArthur Bros., 5 Woodlawn Avenue, have started work on alterations to apartments on Arlington Street, estimated to cost $3,500. Brick veneer construction, felt and gravel roofing.

Albert E. Thome, 125½ Bank Street, contemplates the erection of a residence on Brighton Street, estimated to cost $5,500. Double brick veneer construction, stone foundation, shingle roofing.

Quebec, Que.

Emile Belanger, 39 St. Leon Street, is building a residence on Ninth Street, Limoilou, estimated to cost $8,000. Frame and brick construction, concrete foundation, felt and gravel roofing.

Work has been started by J. A. Mercier, 44 de Varennes Street, on the erection of a residence at Fourth Street and Canardiere Road, estimated to cost $3,000. Frame and brick construction, concrete foundation, metal and asbestos roofing.

Joseph Labrecque, 309 Arago Street, has commenced the erection of a residence on Ninth Street, Limoilou. Frame and brick construction, concrete foundation, asbestos and metal roofing. Estimated cost, $3,000.

Toronto, Ont.

Gordon Bros., 1 DeLisle Street, have commenced the erection of a residence on Stibbard Avenue, estimated to cost $4,000. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started by L. Wilkes, 20 Lincoln Avenue, on the erection of a residence on Kennedy Avenue. Brick construction, shingle roofing. Approximate cost, $3,000.

Work has started by H. A. Johnston, 67 Belhaven Road, on the erection of a residence at 104 Maclean Ave. Smalleer trades will be sub-let. Brick construction, slate roofing. Approximate cost, $8,000.

W. Law, 152 Emerson Avenue, is receiving tenders on plumbing, heating, wiring, plastering and painting required at the residence erected at 30 Thoms Crescent.

Winnipeg, Man.

Work has been commenced on the erection of a residence on Yale Avenue for W. P. Wallace, 194 Yale Avenue. Stone and brick construction, stone foundation, shingle roofing. Estimated cost, $10,000.

CONTRACTS AWARDED

Dundas, Ont.

In connection with the residence being built on South Street for Charles W. Sealey, Customs House, the masonry contract has been let to A. D. Gibbons, 16 Gage Avenue N., Hamilton, and the carpentry to Ritchie & Fletcher, Dundas.

Kent Centre, Ont.

The following contracts have been let in connection with the erection of a residence for Thomas Smith:—general contract and carpentry, J. G. Blakeley, 84 Centre Street, Chatham; masonry, T. Sparks, Sandys Street, Chatham; plastering, Milburn Bros., Fielder Avenue, Chatham; painting, J. N. Martin, Grand Avenue, Chatham; metal work and plumbing, J. C. Wanless, 48 Kent Street, Chatham; interior fittings, Blonde Lumber Company, 49 Dover Street, Chatham. Heating and electrical work by owner. Approximate cost, 3,000.

Kingston, Ont.

Work has been started by E. Burtch & Son, Birch Avenue, on the erection of a store and residence for Thomas Rutherford, Elm and Chatham Streets.

London, Ont.

R. Paisley, 7 Ingleside Street, has let the contract for the erection of a residence to J. Robinson, 267 Talbot Street. Brick construction, concrete foundation, shingle roofing. Approximate cost $3,500.

Niagara Falls South, Ont.

A residence is being built for B. R. Payne by W. E. McCredie, 66 Barker Street. Stucco construction, cement block foundation. Estimated cost, $4,000. Contracts for plumbing, heating and electrical work will be let.

Ottawa, Ont.

The masonry contract in connection with the residence to be built for Alexander MacRie, Arlington Avenue, has been let to R. Beattie, Renfrew Avenue. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

In connection with alterations to apartments on Waverlely Street for T. G. McLaughlin, 315 Frank Street, the heating and plumbing contracts have been let to H. A. Knox, Elgin Street, and the contract for electrical work to J. A. Ellacott, 226 Bank Street. The remainder of the work will be done by the general contractor.

Toronto, Ont.

In connection with the residence being erected at 1589 Dufferin Street by J. Kaake, 29 Springrove Avenue, the plumbing and heating contract has been let to A. Rawlings, 1187 Dovercourt Road, the painting contract to C. Carlson, 179 Earlscourt Avenue, the contract for plastering to C. King, 119 Lappin Avenue, and for wiring to L. Moon, 201 Medland Street.

In connection with the residence being erected for Mrs. Levock, 361 St. Clarens Avenue, the roofing contract has been let to A. Ryan, 962 Bathurst St., the contract for wiring to W. E. Sheppard, 345 Grace Street, and for heating and plumbing to Robert Ross, 1349 Shaw Street.

In connection with the residences being erected at 169-171 Lippincott St., for R. Liddell, 155 Lippincott Street, the general, masonry, carpentry, painting, plastering and wiring contracts have been let to R. Seal, 108 Browning Ave. Some of these trades will be sub-let by contractor, and heating and plumbing will be let by owner. Estimated cost, $4,800.

In connection with the residence being built at 106 Oakwood Avenue for W. E. Link, the contract for masonry has been let to Davis Bros., 94 Eglinton Avenue, and for carpentry to Cameron & Campbell, 578 Queen Street E. Brick construction, shingle roofing. Approximate cost, $4,000.

Trenton, Ont.
J. Whitley is building a residence on Queen Street for Frank Felion. Estimated cost, $3,500.

Westboro, Ont.
The contract for masonry work in connection with the residence being built for H. Richards has been let to R. Beattie, Renfrew Avenue, Ottawa, and for electrical work to J. E. S. Lewis, Westboro. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $3,500.

Westmount, Que.
In connection with the residence and garage built on Sunnyside Avenue for L. J. Ryan, 545 Notre Dame Street West. Montreal, the roofing contract has been let to the Standard Roofing Company, 189 McCord Street.

The following contracts have been let in connection with the residence in course of erection on Willow Avenue for William Bertrand, 145 St. James Street: —general, masonry, carpentry, plastering, painting, heating and plumbing, Anglins Ltd., 65 Victoria Square, Montreal; roofing, Campbell, Gilday & Company, 793 St. Paul Street; wiring, Electrical Repair & Contracting Company, Ltd., 317 Craig Street W. Estimated cost, $6,500.

Willowdale, Ont.
A residence is being built about Stop 35, Yonge Street, for H. Kirby, Willowdale. The masonry and carpentry contracts have been let to William Riddle, Thornhill. Other trades not awarded. Estimated cost, $3,500.

Power Plants, Electricity and Telephones

Saskatchewan Province
Tenders will be received until noon. September 25th, by Thomas Annett, Fairmont P. O., for (1) labor and material, and (2) labor only required in the construction of a telephone system for the Iola Rural Telephone Company. Plans and specifications at the Department of Telephones, Regina, and at the office of Mr. Annett.

Winnipeg, Man.
The Board of Control are considering a scheme for lighting the Main Street Subway. Engineer, J. G. Glassco, 54 King Street.

CONTRACTS AWARDED

Hull, Que.
The contract for the construction of a street lighting system has been let by the City Council to Marchant & Donelly, Sparks Street, Ottawa, at $4,900.

Montreal South, Que.
The Municipal Council have let the contract for electric lighting on Dorval Avenue to W. G. H. Cam, 3 Beaver Hall Hill, Montreal. Installation will include 54 incandescent street lamps, wiring and cutouts.

St. Hilaire, Que.
Work is about to start on the installation of an electric system. The contract has been let by the Municipal Council to the Century Electric Company, 619 St. Paul Street, Montreal, at $7,129. Wires, lamps, poles and transformers will be

Fires

Bridgetown, N. S.
A boiler house belonging to McKenzie, Crowe & Company has been totally destroyed by fire. Loss unknown.

Brownsville, Ont.
A barn owned by Colin Hawkins has been destroyed by fire. Loss on building and contents, $10,000.

Centreton, Ont.
The store and residence of Charles Wilton have been destroyed by fire. Loss, $2,000.

Honeywood, Ont.
Fire has destroyed a barn, the property of R. H. Jamieson, Prince of Wales Rd. Loss, about $2,500, covered by insurance.

Jarratt, Ont.
Fire has totally destroyed a barn belonging to Daniel McLean, Deputy Reeve of Oro, Jarratt. Loss, $5,000, insurance, $2,000.

Jarvis, Ont.
The residence of Joseph McArthy has been completely destroyed by fire. Loss partially insured.

Kemnay, Man.
Fire has destroyed a barn belonging to Alfred Magee. Loss, about $5,000, partially covered by insurance.

Kisbey, Sask.
Fire has entirely destroyed the residence of Joseph Hollingsbough. Loss unknown.

Montreal, Que.
The garage building at 666 St. Catherine Street W., owned by O. W. Southwick, 79 Union Avenue, has been damaged by fire to the extent of about $10,000. Loss covered by insurance.

North Sydney, N. S.
Fire has completely destroyed a tenement building on Clifford Street, the property of J. Salters & Sons, Commercial Street.

Norwood, Ont.
J. E. Roxborough's elevator has been destroyed by fire. Loss unknown.

Miscellaneous

Hamilton, Ont.
J. Huckson, 147 Belleview Avenue, desires prices and information on flush veneered doors.

Medicine Hat, Alta.
The Medicine Hat Pump & Brass Manufacturing Company are in the market for three now or second-hand lathes, sizes 14-inch to 18-inch.

Rosthern, Sask.
The Town Council will call for tenders shortly for the supply of a fire engine, hose, etc. Clerk, George Broden.

Toronto, Ont.
Lord & Burnham, Royal Bank Building, are erecting greenhouses for Sir William Mulock at his residence, 518 Jarvis Street. Steel construction, window glass. Approximate cost, $4,000.

R. N. Murphy, 411 Lisgar Street, is receiving prices, catalogues and other information with regard to sprinkler systems, hot water and steam boilers, cast, black and galvanized iron pipe, plumbing fixtures and radiators.

CONTRACTS AWARDED

Winnipeg, Man.
A contract for the supply of road oil has been let by the Board of Control to the Continental Oil Company, Ltd., 305 Boyd Building, at 8½c. per gallon.

Late News Items

Campbellton, N.B.
Tenders on the supply of a motor street sprinkler will be received until September 25th by the Town Clerk, John T. Reid.

Hamilton, Ont.
The club house of the Royal Hamilton Yacht Club has been totally destroyed by fire. Loss, $26,000, partially covered by insurance. Manager, W. Belson.

Levis, Que.
Work has been started on the erection of a drug store and residence at Commercial and Fraser Streets, estimated to cost $8,000. The general, masonry and carpentry contracts have been let to Albert Shaienks, Guenette and Eden Streets.

Montreal, Que.
Alexander McKay, 298 Argyle Street, is building six flats on Minto Street and six others on Addington Street. Estimated total cost, $30,000.

Work has been commenced by J. Girard, 46 St. Joseph Boulevard W., on the erection of six flats on Ville Marie St., estimated to cost $7,000.

Ottawa, Ont.
The general contract for alterations and additions to a warehouse on Clarence Street for the Ottawa Dairy Company, Cooper Street, has been let to H. P. Beck, 126 Sparks Street. Pressed brick construction, felt and gravel roofing. Approximate cost, $8,000.

Sioux Lookout, Ont.
In connection with the school now in course of erection, the contract for roofing, plastering, painting, heating and plumbing has been awarded to Wells & Emerson, 17 Cumberland Street S., Port Arthur.

Stratford, Ont.
The City Council have let the contract for the erection of a standpipe for the Waterworks Department to the Chicago Bridge & Iron Works, Sarnia, Ont. The cost of the pipe, exclusive of the base and two gasoline pumps is $24,800, the approximate total cost being $50,000.

Toronto, Ont.
Lord & Burnham, Royal Bank Building, are erecting a number of greenhouses for Sir John Eaton at his residence, 480 Davenport Road. Steel and brick construction. Approximate cost, $14,700.

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Efficiency in Sewage Disposal Plants

UNDER the heading "The Provincial Control of Sewerage and Sewage Disposal," we publish in this issue an abstract of an address by Dr. M. M. Seymour, President of the Canadian Public Health Association, at the meeting of that body held recently in Toronto. Dr. Seymour is the Commissioner of Health for the Province of Saskatchewan, and has been connected with some of the most advanced provincial legislation dealing with the problem of stream pollution.

Saskatchewan was the first province in Canada to adopt legislation enforcing sewage treatment, so that the conclusions arrived at by Dr. Seymour cannot fail to be suggestive and interesting. The abstract of his address shows a broadness of conception which amply explains the satisfactory results which have been obtained in the Middle West.

For the last five years Mr. T. Aird Murray, of Toronto, has been associated with Dr. Seymour as consulting engineer on this work, and it must be a source of gratification to both of these gentlemen that the province of Saskatchewan, in proportion to its population, can show more up-to-date and efficient sewage disposal plants than any other province in Canada.

Dr. Seymour's observations with reference to the necessity of continuous inspection and efficient operation merit the careful consideration of those in charge of such works. It is obvious that the mere passing of plans by authorities is no guarantee of working efficiency, and that such can only be obtained by the viligance of those in charge, supported by expert inspection on the part of a central authority.

War-Time Economies

BY way of contrast to the Canadian viewpoint as to the possibility of carrying out municipal works economically at the present time, as outlined for this journal last week by Mr. Wynne-Roberts, special interest attaches to the article on Municipal Economy contributed by Mr. W. H. Maxwell, Borough Surveyor of Tunbridge Wells, to the London Surveyor, and reproduced in this issue. It is noteworthy that both writers practically agree on the main issues, but that the Canadian viewpoint is marked by greater buoyancy and more optimism than the English one. On the one hand we are told that city work, like the babbling brook, should go on steadily for ever. Here we have the idea of continuity. On the other hand we are told that "the doubtful doctrine of 'business as usual' must perforce give place to one of 'nothing as usual'." The Canadian writer admits the necessity of practising sane economy, but points to the fact that necessary works can be carried out to great advantage, the reduction in the cost of labor and materials being at least twenty per cent. The English writer inclines to this view when he says, "In all matters of public health little opportunity arises for curtailment of expenditure, except in cases where some item of wasteful or excessive expenditure is known to exist. Beyond this any material reduction is likely to prove to be false and expensive 'economy'."

We are told that the great thing to be avoided is the curtailment of the efficiency of any of those services which directly affect the public health. If this is so, the whole field of municipal enterprise is left open to steady progress. We must have efficient sewerage and sewage disposal; we must have an adequate and pure supply of water; we must maintain efficient fire-fighting departments; we must give the required attention to the maintenance of our highways; and we must burn up our refuse—however long it take to eliminate the Kaiser factor. With the objection to the 'business as usual' sentiment we are in sympathy, but it is a far cry from that to 'nothing as usual.' Let us strive, as Mr. Wynne-Roberts told us last week, to "keep moving—however slowly."

The Trumpet-Call of Confidence

THE letters relating to the Robert Simpson Company's award published in this issue will, we suppose, bring the discussion of that unsavory incident to a close. Enough has been said to expose the injustice of passing over the Canadian contracting interests when there are firms in Canada capable of handling any kind of constructional work, large or small, and far more capable than any outsiders owing to their intimate knowledge of local conditions of soil and climate.

One of our correspondents observes that the amount which will pass into the pockets of the Chicago firm that is putting up the Robert Simpson Company's building at Regina will probably be about $75,000. This is a considerable sum for an individual—from an editor's viewpoint, at any rate—but not much for a community, and in registering our protest in the matter we were considering the principle involved, and not the money at stake. Rather are we in sympathy with "Onlooker," who tells us how on a previous occasion the Simpson Company entertained the idea that **"there was not a firm of engineers in Canada capable of designing a flat-slab reinforced concrete building, or a firm of contractors capable of building one."** It is ideas of this kind that must be quashed, for as a rule they have no foundation at all, resting upon the fallacy that "Canada is a long way behind the United States."

Behind! Canada is ahead of the United States; and well she may be—for the United States is only one of a number of countries upon whose experience Canada has been able to build. Not only have we the example of the best that the United States affords, but we have the worst, and from both we are able to derive some profit. In her shorter day and generation Canada has produced far more great constructional men in proportion than the United States. We have great men to direct our constructional enterprises, and great men capable of carrying them out. To mention but three who have passed away in recent years—Peter Lyall, Sir Sandford Fleming, and Sir William Van Horne—in these we have a triumvirate of intellect and experience equal to anything. It may not be well to refer to those who are still with us, for the reason that the great men among living engineers and contractors in Canada are so numerous, and selection is invidious.

These observations are not made as statements of opinion; they are made as statements of facts. They are conceded to be facts by those whose opinion in such matters is final. The people of Canada believe them and are inspired by them.

In Canada we do not practise the same amount of self-advertisement as our neighbors across the line, and to the conservative British ear what has been said here on behalf of Canada may sound a jarring note. It seems, however, that such is the proximity of Canada to the United States that if Canadian engineers and Canadian contractors do not sound their own trumpet there is little chance of its being sounded for them—even in their very midst.

The Labor Situation at Montreal

ENQUIRIES show that the labor situation has recently undergone an interesting development, so far as Montreal and district are concerned. In the spring there were thousands of men available for road and other construction work; wages were reduced, and men would work for very small remuneration. One reason for this surplus of labor was the holding up of road construction owing to the policy of the Quebec Government, who were unwilling to make progress with the good roads programme. The Government were very slow in making grants to the various municipalities, with the result that contractors who had received contracts were unable to go ahead with the jobs. This placed many firms in an awkward position, as they had a large amount of equipment on hand which was lying idle. Early in the year considerable local labour was available, but as the Government did not make any move in the matter of roads, this was not required, and certain sums of money were lost to the various districts. Later, this help found employment on the land.

About the end of August the labour market changed, and instead of a surplus of men there was a scarcity. The enlistment of tens of thousands of men, the migration to the West on account of the harvest, the continued employment in the munitions factories, the engagement of labourers by the city of Montreal, which pays a higher rate than contractors, the internment of Austrians, the calling up of Russians and Italians to the colours, and the large migration to the United States, have all contributed to the absorption of labour. Wages have naturally risen under the pressure of the better demand, and even at the higher rates there is difficulty in obtaining a sufficient supply of help. The railway companies have offered inducements to men of the class required (chiefly foreigners), but even these have failed to bring the labour desired. It may be that this scarcity is only temporary, although if the additional war orders materialize there is a probability that it will continue for some time. In certain classes of labour there is still a surplus; but these are mainly men who have no desire to leave the cities, and who are not of foreign origin.

The Engineers and Architects' Registration Bill will probably be introduced into the Legislative Council of New South Wales within a short time now. The consultive committee of engineers and architects have made their final recommendation, and the draft measure has been forwarded to the Chief Secretary's Department. Our Australian contemporary, Building, published in Sydney, states that generally speaking, it is a satisfactory measure.

Fire Engineering

It is an acknowledged fact that the fire losses in Canada are many times greater than they are in Europe. It requires no excuse to refer to the matter, as many claim there is room for improvement. In the September issue of "Conservation" it is stated:—

> At the request of boards of trade, municipal councils and other public bodies interested in the subject, the Commission of Conservation has decided to undertake an investigation into the fire waste in Canada, with a view to suggesting means to overcome the heavy annual fire losses. The inquiry will be conducted under the direction of Mr. J. Grove Smith, B.A., B.Sc., head of the statistical department of the Canadian Fire Underwriters' Association. An exhaustive study of both cause and effect of Canada's fire loss will be carried out, and a report embodying the result will be published by the Commission as soon as this work can be completed.

This is one of the most important works that the Commission of Conservation could undertake, as it is highly desirable to find means by which a material reduction of the annual losses can be effected. The problem will doubtless be attacked from many sides,—the forests, prairie and farm, the village, town and city will each require separate consideration and a different solution.

A village is often so scattered and usually so rural in character that the risks are small and fires can be attended to by a small volunteer brigade. As the village grows into a town the hazards increase rapidly and when it becomes a city of some magnitude the duty of the fire department has become one of no mean importance. The conservation of lives and property is then a most important function of the city administration.

At the present time the principal duty of a fire department is to extinguish conflagrations. This, of course, is due to the development of the departments from smaller beginnings and the tendency to follow the old grooves. It should also include that of fire prevention. The fire department should be in the position, par excellence, to advise the public what is necessary to be done to minimize the risks and losses due to fire. It is insufficient that it should attend to fire extinction alone, for the primary function should be to institute a campaign to prevent fires.

If the fire department is to be in the position to advise people on different matters, it should be able to collect information and gain experience. It should therefore undertake to conduct investigations with regard to the value of different materials from the fire-resisting point of view. These are days when new materials and new combinations are placed on the market in great numbers. But at present, so far as we are aware, there is no Canadian Fire Department or other organization which is equipped to undertake this work. All progressive cities—and certainly those of the importance of Toronto, Montreal, Winnipeg, and Vancouver—should so equip the fire departments that new materials and combinations of materials can be tested to ascertain their fire-resisting properties; otherwise the makers of such goods must depend upon the tests conducted elsewhere, and the users must accept the published statements at face value. This may be a somewhat treacherous proceeding, for the plausibility of some people will persuade others against their own convictions, and the property owner will often live in false security—often spending enough to ensure ample safety against conflagrations. Such tests would furnish the men with most useful knowledge, making them more expert in their fire-fighting duties, and the public would derive through the department reliable data as to the value of various articles.

Fire equipment is another branch which deserves more attention. This includes the testing of various kinds of extincteurs, hose, fittings, and so on. There is also the precautionary work in connection with the storage and use of various kinds of oils, the testing of oil, acetylene, gasoline and other lamps, explosives, and the inflammability of oils.

There are many buildings furnished with fire connections and equipment which are inadequate and seldom examined or tested, so that in the case of fire they are of little value. The periodical testing of private fire installations, drenchers, sprinklers, etc., observing the working pressures and the delivering capacities of water mains, would enable the firemen to be acquainted with the situation and conditions before a fire occurred.

The education of the public by literature, lectures and displays in respect to methods of fire construction, types of lamps which are dangerous, defects in heating, lighting and cooking arrangements, means necessary to prevent the spread of fire, and so on, would constitute a valuable step in the right direction to secure a reduction in fires. If the public is enlightened by persistent advocacy of the essential conditions to preserve property and lives it will in due time adopt the advice, and such advice could come from no other source with equal force as from the fire department.

It may be stated that the above work belongs to and is attended to by other departments. That is doubtless true, but the risks warrant the work being doubly done, and furthermore, the fire department should not be dependent upon other departments for the efficiency of their own service and the reduction of fire hazards. The fire department must be encouraged to do all that is necessary to ensure a low annual loss and to secure the most favorable rate of fire insurance, which will produce an excellent effect from the commercial point of view.

The fire department should co-operate with the building department in connection with fire equipment, fire escapes, exits, and construction, both before the approval of the plans and during the construction.

It is highly desirable that Toronto and other large cities should take the lead in these matters. It is not to their credit that in these matters guidance comes from cities across the border, for Canadian cities by now should have an individuality of their own. In many things it is desirable that we should adopt the best ideas of the United States and at the same time build up some of our own. We have our own problems to solve, and it can only be done if the city authorities provide the facilities, organization and encouragement.

The fire department is an essential and integral part of a city's administration, and as such it can be made efficient, progressive, and an institution of which the city would be justly proud. It will be acknowledged that the fire department consists of men of great fire-fighting ability, but it will also be admitted by them that they would be of still greater value to the community by extending their functions on the lines suggested.

Public Recognition of the Engineer

IN Western Canada, at any rate, the engineer would appear to be coming into his own, if one may judge from the following editorial which was the leader in a recent issue of the Manitoba Free Press. Incidentally this article is of additional interest in its reference to the important new farming territory which the construction of the Greater Winnipeg Water Scheme is opening up.

It has been well said that the work of the civil engineer is beyond value to the community; that however well he may be paid—and except at the top of the profession salaries are on a scale much lower than the earnings of the average professional man—it is impossible to reward him commensurately with the intrinsic worth of the service performed; and that the public is ever deeper in his debt, for the work he does in his generation—ill-requited but priceless—benefits untold generations to come.

A sense of this was present in the minds of the representative section of the Winnipeg public which last Monday travelled over the Greater Winnipeg Water District Railroad to Indian Bay. They were prepared to see, and did see, a wonderful engineering conception on the high road to successful completion; they found the work greater than they could have imagined, because theirs is not the imagination of the engineer, the imagination in fact that makes smiling places of the desert and with a wave of his magic wand brings ordered system out of chaos; they were immensely impressed and wonderfully informed; they found that everything had been thought about many months ahead, down to the smallest practical detail; everything was in its place, co-ordinated to one great end. All this they saw, and entered in some way into the spirit of a great engineering achievement. But they saw beyond even all this: they saw a new country in the making.

The admirable annotated time-table supplied on this trip sets out in black and white this aspect of the enterprise, namely, that this engineering scheme, designed primarily to assure in perpetuity a visible supply of water to the Greater Winnipeg District, has incidentally and almost unconsciously opened up a magnificent farming territory until recently supposed to be nothing better than swamp, muskeg and scrub bush.

From Deacon (nine miles east of Winnipeg) for twelve miles the line passes through fine farming country, devoted to dairy, grain growing and cattle raising. It was in this section that wheat-fields, estimated at over thirty bushels to the acre and all in stook, were to be seen. For fifteen miles more the country is generally bush, with open hay meadows and clearings, the section being easily cleared and well adapted for mixed and truck farming and dairying. Another thirteen miles east is heavily timbered and unsettled, but drained and cleared will make a good cattle-raising country. This is carried nearly up to Whitemouth River, where the land is very good for mixed farming, with a subsoil of heavy and sandy clay, and a foot to eighteen inches of top soil, making it ideal for garden truck and grain. From Birch River crossing almost to the end of the line at Indian Bay there is good soil covered with heavy bush, spruce, Jack pine, tamarac, poplar and some cedar, all valuable as cordwood, only needing clearing to make the best possible dairy and truck farming land.

Thus nearly the entire line runs through a farming country of great possibilities. Already the wilderness is being transformed: settlement is springing up, and the axe, followed by the plow, is eating into the bush. At two points vast piles of cordwood, cut by the city's unemployed last winter, were to be seen, and development along this line is almost limitless.

All this is the work of the civil engineer—the by-product of his genius. No calculation of the cost and revenues to be derived from the great enterprise took into account the opening of a magnificent country tributary to Winnipeg, and the building of a colonization road bound to pay dividends on invested capital. The road was built as a necessary step towards the aqueduct, but now it promises to justify itself as an economic venture.

The civil engineer is the true forerunner of civilization. Through trackless wilds he blazes his survey lines, and under hard conditions he faces and overcomes natural difficulties. He is sustained and fired by the vision that describes in arid wastes or marsh lands the homestead, the settlement, and in time the prosperous community.

In a pamphlet published by the International Correspondence Schools, Limited (London, Eng.), it is pointed out that probably no industry will profit more after the war than the building trade. The ensuing general commercial prosperity, says the writer, will involve a considerable amount of building work, such as factories and similar erections. There will also be the work of rebuilding the destroyed and damaged portions of France, Belgium, and Poland. All of this will involve the supply of huge amounts of building materials of all kinds. In fact, the business to be recaptured, or to be simply held against future German competition, is threefold: the securing of home building contracts and the employment of native personnel; the securing of foreign contracts; and the capture of the orders for materials, both home and foreign, that have hitherto been secured by Germany.

A Consular report from Shanghai states that it would be of considerable advantage if British manufacturere would place stocks of iron and steel bars, plates, angles, etc., in the hands of reliable representatives in Shanghai—especially mild steel bars for reinforced concrete work, for which there is a constant and growing demand.

"A nation is bound together by its means of communication. Its means of communication create its thought. Its means of intercommunication are the means of its sympathy: they are the means by which the various parts of it keep in touch with one another."—President Wilson.

An instance of general manufacturing activity is found in the statement that in one week the Purchasing Committee of the Dominion Government placed an order with Canadian manufacturers for some two hundred thousand shirts, the cost being estimated at $240,000.

The Provincial Control of Sewerage and Sewage Disposal[*]

THE problem of efficient sewerage and sewage disposal is one of the most important branches of public health work. With this problem are interlocked many other factors such as wholesome air supply, wholesome subsoil conditions, pure water, satisfactory milk and avoidance of disease transmission. Health authorities cannot afford to neglect this important phase of work, and it requires control dictated by the best scientific and technical knowledge.

Before the water carriage system of domestic sewage was introduced, the problem was simply one of efficient management and attention with reference to protection of waste matters and their ultimate surface disposal. All appliances and operations were above ground, subject to inspection, and although accompanied by many objectionable features, the privy, or earth closet system, if properly operated gave better results than a water carriage system badly designed and badly constructed.

The water carriage system, or system of laying underground pipes through which domestic sewage is flushed or carried by water, brought about conditions requiring an ultimate point of discharge where a large amount of water accompanied by a proportionately small but dangerous amount of sewage is concentrated.

The early custom of this country, as with all other countries, was to treat this discharge simply as drainage, and outlet it into any convenient stream or natural topographical drainage artery. The objections to this custom have become very apparent with our knowledge of the transmission of disease infection, and a growth of population is always now accompanied with a struggle to obviate the objectionable features of the water-carriage system of sewage. The natural topographical drainage arteries present in many cases the only sources of water supply for municipalities, farmers engaged in stock raising, milk-producing, etc., and naturally there is a growing and decided objection to these water supply sources being mixed with and contaminated by domestic sewage. The efficient control of this problem is perhaps one of the most difficult in public health work, as different localities and varying conditions appear to call for expert or independent investigation and final treatment. The problem naturally divides itself into two parts—(a) the sewer system, and (b) the question of what to do with the sewage. The whole subject, however, is so interwoven with engineering and chemical questions that it is difficult to deal with it in detail in an address of this nature. Certain generalities however, may be admitted—generalities which are, or may be, the basis of health regulations and control. The main difficulty in formulating specific regulations dealing with engineering and chemical propositions of this character appears to me to exist in the reasonable acknowledgment that the whole subject has not yet arrived at anything like final investigation and determination. A few years ago we were led to believe that the septic tank was the final word in sewage disposal. Then the British Royal Commission on Sewage Disposal opened our eyes to the defects of the septic tank, and told us that the sludge question was just as alive as ever. Now we have much talk and literature with reference to a double deck tank, the lower deck being the old septic tank and the upper one a continuous flow tank. Last of all we are told that if we will only keep stirring the liquid sewage along with the solids for a sufficient length of time, and pump air into it, it purifies itself, this being called the "activated sludge system..' Now suppose we were to introduce specific regulations with reference to motor cars and state a required form of construction in detail and prohibit all other designs, we should at once cancel all development in improved design and construction; and so with reference to sewage disposal we must be very careful in any of our regulations that we are not stultifying initiative, or encouraging conservative uniformity.

Legislative regulations with reference to control of sewerage and sewage disposal must be general and only include factors which may be accepted as axiomatic.

In any new system, or in any alteration to an old system, the chief aim should be to separate the domestic sewage from the surface water. The adoption of what is termed the combined system, which discharges both domestic sewage and street surface water, appears to lead to no end of trouble, in the event of final treatment of the effluent being required. The fluctuation between the ordinary domestic sewage flow and extraordinary rainfalls appears to demand an elasticity in any disposal works both difficult and costly to obtain. In fact it appears that with the combined system the only practical method is to allow a mixture of sewage and surface water over a fixed volume to discharge without any form of treatment. This, of course, can never be wholly satisfactory. Apart from the question of sewage disposal, the combined system of sewerage provides a very objectionable feature, as the sewer pipes must have a sufficient diameter to take maximum rainfalls apart from the ordinary domestic flow; consequently except under high rainfall conditions the sewers are not properly flushed and act as containers for sewage solids, with the resultant sewer gases and chokages. The sewers for a domestic flow should be just of that diameter that they will effectually deal with the flow, providing a depth of flow sufficient to carry all solids as rapidly as possible. Street and surface water should be dealt with by an entirely separate system of pipes. Regulations should provide for water-tight joints and a sufficient number of manholes to provide access to the system at all bends and changes of gradient, and not more than 250 feet apart. In hilly districts special ventilation pipes should be provided in lieu of manhole open gratings.

Is it possible to imagine anything more objectionable than a system of underground sewers, which are leaking their contents into the surrounding soil; or a system in which the solids collect, undergoing purification, awaiting a rain-storm for their removal; or a system which in the event of any choke requires breaking into, with all the inconvenience to the public adjoining? Regulations can be formulated and insisted upon which will guard the public against many of the objectionable features attending a sewer system carelessly designed or carelessly constructed.

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[*] Extract from the Presidential Address of Dr. Maurice M. Seymour, Commissioner of Health for Saskatchewan, delivered at the Annual Meeting of the Canadian Public Health Association, Toronto, September, 1915.

What to do with the Sewage

It is apparent that the time is fast approaching when Dominion legislation will prohibit sewage discharges from entering inland waters unless previously treated. Several of our provinces have already adopted independent or local legislation requiring any scheme for sewerage to be accompanied by a system of sewage treatment. Regulations with reference to sewage treatment must, as has been stated, be of a very general character, each case being dealt with practically or its merits with reference to local conditions. What may be considered necessary in one place may prove a hardship in another. In the province of Saskatchewan we have certain cases where the sewage is diluted by rivers of large volume, and others where the streams receiving sewage are practically without flow in the summer season. In the latter cases the streams form ponds throughout their beds, which in the past have been used for watering stock, and it is important that the value of these streams for stock watering be preserved as far as possible. This demands a high degree of chemical purification and calls for extensive and costly plants, both for the removal of solids and for the oxidation of the organic matters in the liquid sewage. Our regulations, therefore, are of an elastic character, and I cannot see how they can be otherwise. Our chief aim, in most cases, is to destroy the infective properties inherent to sewage discharges. For this purpose we find that chlorine is the best disinfectant agent, granted that the sewage has undergone a preparatory treatment for the removal of solids, and in some cases for the removal of putrescibility, by aid of percolating filters. The two-storey tank appears to present certain advantages over the septic tank, or the continuous flow sedimentation tank, from which the solids are periodically removed before they putrify. The two-storey tank delivering a fresh sewage liquid is favorable to the action of percolating filters or to chlorine disinfection, while it delivers a form of sludge easily handled and well rotted. The septic tank is practically scrapped, and where continuous flow sedimentation tanks have been constructed, such are being re-constructed in many cases into two-storey tanks.

Apart from regulations with reference to design and construction, a public health department is at a disadvantage with reference to the most important factor in obtaining results from sewage disposal works, viz., control of management. We find that with the changing of the personnel of municipal representatives and of engineering staffs it is extremely difficult to maintain the required attention to the operation of sewage disposal works. Obviously this can only be counteracted by frequent inspection and reports, so that municipalities may be fully persuaded that permanent and expert management is constantly required in order to keep works tuned to their possible working efficiency values.

Perhaps one of the main advantages of the two-storey tank is that it does not require anything like the amount of attention in connection with sludge removal as other sedimentation tanks. A decided advantage is gained by providing, say, six months' sludge storage, or a period which will carry well over the winter conditions. When tanks of the ordinary type have been installed, although all the appliances and valves may be at hand for the removal of sludge, they are usually neglected to the extent that they are operated as septic tanks. This applies even more particularly to humus tanks used for the purposes of collecting suspended solids evacuated from percolating filters. This humus we find to be as a rule highly putrescible, and if allowed to enter a stream of small volume it forms beds of black mud deposits of a highly objectionable character.

We have a very complete installation of sewage disposal works in connection with the city of Regina, where the discharge enters a creek of small volume and practically without natural flow during some seasons. The works consist of preliminary screening, continuous flow sedimentation tanks and percolating filters of rough broken stone. The sedimentation tanks provide a contact period of about six hours while the filters are rated at about one acre per each 20,000 of population. The liquid sewage from the filters is passed through final sedimentation tanks, allowing two hours' contact. The tanks are all built on the one-storey system, and valves and appliances are to hand for cleaning out the collected solids at necessary intervals. Recently, complaints as to the condition of the water were made by farmers located on the banks of the creek below the outfall works. An examination of the works early this spring proved that the removal of the collected humus was being neglected and that the tanks were practically full of solids, which were being carried away by the flowing sewage into the creek and causing the nuisance complained of. It was calculated that at least 347 cubic yards of humus matter had been allowed to discharge into the creek—an amount sufficient to use up the dissolved oxygen at 14 degrees C. from 17,350,000 gallons of water. Considering that the natural flow in the stream has been at zero for the last two years, it is easy to understand that there was good cause for complaint. The point which it is desired to make is that the use of the two-storey tank with six months' storage for humus would have taken the place of the necessity of removing the accumulated sludge every forty days required by the size of the tanks. Attention to cleaning out the tanks has since cleared up the effluent to a remarkable extent, although for a considerable distance below the works the stream continues to suffer from the previous collection of humus.

It appears that the duties of a provincial health authority cannot be said to cease when plans for any proposal have been submitted and authorized. In order to obtain and maintain efficient results regular inspection of all work is absolutely necessary.

A somewhat unexpected argument in favor of reinforced concrete flooring is furnished by an incident which occurred in a New Orleans hospital. It appears that a patient received an abrasion of one arm in falling from a bed, with the result that erysipelas developed. The medical superintendent had contended for a long time that wooden boors in hospitals must necessarily be infected with various disease germs, and after the case mentioned he caused the floor to be examined by the bacteriological department, with the result that the flooring of the entire ward was found to be infected with the germs of erysipelas.

There are nearly eight thousand miles of the C. N. R. lines in operation in various parts of Canada, with another 1,250 miles ready to be thrown open for traffic.

LETTERS

Carpeting Macadamized Roads with Bituminous Material

Editor, The Contract Record:

There is one point in road construction which might be given your consideration, and that is the carpeting of macadamized roads with a bituminous material. The city of New Westminster has recently laid a mile of two-inch standard bitulithic paving on top of a six-inch macadamized road which was just beginning to deteriorate. The method of construction was as follows:

The six inches of macadam was lightly scarified, brought to grade, and about one inch of new rock placed on top. The standard bitulithic carpet was then laid on top of this. The cost was fifty cents a yard cheaper than the ordinary pavement, and in my opinion the work will last just as long, as the foundation of the macadam road has had the apprenticeship of consolidation, and will probably stand up better than a new road. There are many miles of existing macadam roads that are in good condition, and with the addition of a bitulithic or bituminous carpet they will last many years longer. During the further period the public will have an excellent travelling surface at all times. There are no arguments against this form of construction, because statistics as to the cost of the upkeep of macadam roads are available every year.

This work that I have carried out is, I believe, the first of its kind in British Columbia, and I have had many municipal representatives here to inspect it.

Yours truly,

J. W. B. BLACKMAN.[*]

New Westminster, B.C.,
September 23, 1915.

Patriotism in Awarding Contracts

Vancouver Firm's Appreciation

Editor, The Contract Record:

We are pleased indeed to note the firm stand you have taken in regard to the unfortunately too prevalent custom of many large business concerns of awarding contracts for Canadian construction to American contracting firms and supply people. Your recent editorial on the subject of the action of a large Toronto departmental store in awarding the contract for their new building to a Chicago contracting firm will strike a responsive chord in the heart of every Canadian contractor reader of your valued publication.

The firm in question is regrettably not the only concern that violates the principle of supporting home institutions—a principle which every Canadian citizen should uphold, more especially those large business concerns who are building themselves up out of the profits taken from the Canadian people and out of Canadian soil. These should set an example of loyalty to the smaller concerns, instead of encouraging a method of operation which, if universally followed, would spell disaster to any country, and which even in the extent now practised in Canada has a retarding effect on the growth and prosperity of the country to a degree that would astound the average citizen if all the facts were made known.

We are firmly of opinion that if Canadian publications followed your lead in giving publicity to actions of this kind—emanating from firms whom Canadian citizens are justified in expecting to spend their money at home in the encouragement of Canadian institutions and the employment of Canadian artisans—the practice would rapidly fall into decline. The limelight of publicity generally has a very salutary effect when natural loyalty, argument or logical reasoning fails to awaken a sense of duty in the minds of men in charge of the affairs of large concerns guilty of practices of this kind.

We congratulate you on your policy, appreciate the great value of it, and wish you the acme of success your efforts surely deserve.

Yours truly,

J. COUGHLAN & SONS.

Vancouver, Sept. 21, 1915.

* * *

Consumers' League Suggested

Editor, The Contract Record:

At a time like the present, when every loyal Canadian is doing his bit for the Empire in the struggle against German **kultur**, and when business is so slow on account of the war, one would think that every corporation, whether governmental, municipal, or private, would strive for the conservation of Canadian resources and endeavor to keep Canadian money in circulation in Canada. The public who are subscribing to various funds for war purposes will surely look askance at a firm which deliberately ignores Canadian business men and places a large contract in the United States. The Simpson Company's new warehouse at Regina is not being built from philanthropic motives: it is being built because the Westerner is a good purchaser. With this in mind it is too bad that Western money should be taken to foster industries in the United States, and not in Western Canada, where they are needed so badly.

In British Columbia there is a Consumers' League, whose objects are "to encourage B. C. industries and induce new industries to establish by patronizing B. C. goods and B. C. products." There would appear to be a good opening for a league of this kind in the Prairie Provinces. The first duty of such a league would be to get the City Council and others in authority to insist on the use of local material—provided, of course, that the prices and the quality were right. Failing satisfaction being given by civic and other bodies, the remedy would be in the consumer's own hand. It is never too late to mend, and I think that if such a league were formed in Regina and its objects because well known, the mail order house in question would find that it had made a mistake in this contract.

Yours truly,

J. HART.[*]

Vancouver, September 20, 1915.

* * *

A Loss of $75,000?

Editor, The Contract Record:

I have read with interest the many letters relating to the Regina award. As a Regina contractor I will not discuss the insult to Canadian architects and contractors, but as a Canadian citizen I must express my disapproval of the principle of awarding a contract to a Chicago firm without giving Canadian contractors the opportunity to tender on the work.

The particular effect upon the Canadian building trades will be very slight, and Canadian labor and those who are interested in the manufacture of building materials in this country cannot suffer much. To me the worst feature in connection with this award of a $350,000 contract to a foreign firm is the money that it takes out of the country. There are the salaries and wages of a foreign office staff, a foreign superintendent, and foreign foremen. There is the architects' fee of five per cent., and there is the contractors' profit—shall we say only ten per cent. in this case?—in all about $75,000.

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[*] City Engineer, New Westminster, B.C.

[*] Treasurer, B.C. Consumers' League.

The effect of this award upon the letting of future contracts is not worth considering, as it is doubtful if it would be possible to find another firm doing business in Canada who would show such lamentable lack of patriotism as the Robert Simpson Company.

Yours truly,
E. E. POOLE

Regina, Sept. 20, 1915.

* * *

Malice Aforethought

Editor, The Contract Record:

Your discussion of the Robert Simpson incident has been very interesting. Some time ago the company was thinking of putting up a mail order business building in Toronto. In a conversation that I had with one of the officials of the company it developed that they intended to employ a firm of Chicago engineers and contractors to put up the building for them. **They did not think that there was a firm of engineers in Canada capable of designing a flat-slab reinforced concrete building, or a firm of contractors capable of building one.** As it happens, the building was not constructed, as they found a suitable one and bought or rented it.

ONLOOKER.

* * *

A Side-light

Further light on the procedure followed by the Robert Simpson Company is shed by the following extract from a letter submitted to The Contract Record by a prominent local contractor:

"On Monday, July 26, a Mr. Grimbly, the Simpson Company's Structural Manager, arrived in town and saw a number of contractors and supply men. He told us that they were in such a hurry that it would be impossible to prepare complete plans and specifications, but that he would give us sufficient information to make up our price. On the Thursday and Friday of that week—July 29 and 30—we received one ground-floor plan and one typical floor plan of an eight-storey building 250 feet by 100 feet. We were also given a photograph of a six-storey concrete building in Chicago, and we were told that the Simpson Company's building was to be built like that. Certain typewritten sheets—specifications, so called—were also handed to us. On these two plans the only sizes given were the length and width of the building. The position of the concrete columns was indicated simply by small round circles. No sizes or details of any description were on these plans, neither were there any details of any kind contained in the specifications. No steel plans were offered, and the floor loads only were given. The specifications were called 'preliminary specifications for reinforced work.' The other trades were simply a few indefinite instructions—mostly on a single sheet of paper.

"We were advised that our figures must be in the Toronto office not later than the evening of Monday, August 2nd. This gave us only a few hours if our letter was to go by mail, and only two working days if the figure was to be wired in."

If these statements are correct it is obvious that any dealings which the Robert Simpson Company had with the Regina contractors were only in the nature of a bluff at giving them an opportunity to bid.

In closing this discussion it may be well to point out that nothing that has been said by this journal or communicated to it has reflected in any way on Messrs. Wells Brothers, of Chicago, who it is generally understood are a first-class firm with a very fine record of large buildings in the United States to their credit.

Contract Investigation at Vancouver

At Vancouver, recently, the Board of Works met to explain why a contract for piling for Government work in False Creek had been awarded to a Tacoma (Wash.) firm. As a result the Board appointed a number of Aldermen to attend a meeting of the Harbour Board, and invited representatives of the Manufacturers' Association to make investigations with a view to clearing up any doubt there might be as to the prices tendered for the piling. The trouble arose over the complaint that local firms had been passed over for a Tacoma industry. For the Tacoma firm it was contended that they employed white labour and had to pay freight and duty into British Columbia, and yet could underbid by more than $2,000 a local firm which employed Hindoos. Mr. H. H. Stevens, M. P., said that the Harbour Board had a fixed policy of giving all they possibly could to Canadian firms, everything else being equal, but where local firms could not compete with the figures of outsiders they had no choice in the matter. If they were to establish a principle of giving local manufacturers material advantage simply because they were local manufacturers, then they could not compete with the world; and they knew this—that no manufacturing centre could develop on the business it obtained from its own district, and that to go on living it must compete with the world. A resolution of confidence brought the discussion to a close, and the award of the contract to the Tacoma firm was ratified.

Damages Awarded for Cancellation of Contract

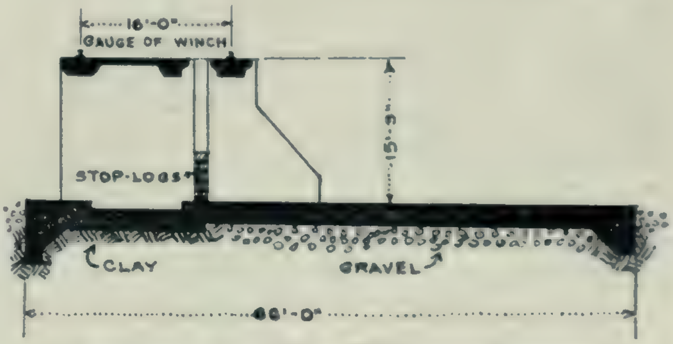
An award of $13,776 has been made by Mr. Justice Clement, acting as arbitrator in the claim made by the Union Contracting Company against the city of Vancouver for damages sustained on account of the cancellation of the contracts for the Pender, Keefer, and Harris Street viaducts. The company's original damage claim approximated $44,000 as filed with the city engineer, but when the matter went to arbitration this was amended to $32,000. The amount calculated by the city engineer as the damage sustained by the company through the non-fulfilment of the full contract was in the neighborhood of $5,000, three thousand being on the claim for cancellation damage and $1,800 for various incidentals. The result of the award evidently turned on the date of suspension as, if this was taken to be May 19, 1914, then an amount of lumber purchased after that date could not very well have been taken into consideration, but if it was December of the same year then the lumber would have to be paid for by the city, as it had been purchased in good faith that the suspension was only temporary. If this latter date was the correct one, according to the arbitrator's view, then the amount of $5,000 allowed by the city engineer was approximately correct, as the lumber would about account for the difference between the $5,000 allowed by Mr. Fellowes and the award. Claims for extras on the Hastings Street East viaduct were disallowed. Four-fifths of the costs have been awarded against the city.

Permanent Headworks for the Western Section of the C.P.R. Irrigation System

Special Correspondence of the Contract Record

THE permanent headworks for the Canadian Pacific Railway Company's Main Canal for the western section of their irrigated lands have been completed and in operation during the past season. The old timber headworks have been replaced by a concrete stop-log dam with a hydraulically-operated steel sector weir designed to divert the river without backing the water into the city of Calgary. The western section comprises a total area of over one million acres, water being diverted from the Bow River at a point within the south-eastern limits of the city of Calgary. At this point the Bow River has an ordinary discharge of from 1,500 to 25,000 second-feet during the spring and summer months. The section of the main canal varies from the maximum bed-width of 60 ft. at the headgates, with side slopes of 3 to 1 and 0.01 per cent. grade, to a bed-width of 44 ft., 2 to 1 side slopes, and a grade of 0.02 per cent., having a calculated discharge of 2,050 second-feet at full depth of 10 feet over a distance of 17 miles. The canal terminates at Reservoir No. 1, from which three secondary canals take out. In order to supply the main canal with the full depth, it was necessary to construct a diverting weir, or dam, to raise the water surface to the desired elevation, which otherwise only occurs during extreme high water, and the new permanent headworks are designed to maintain the maximum depth of 10 feet required for the calculated discharge at all stages of the river without creating a backwater which would flood the lower portions of the city of Calgary, one mile upstream. The former headgates were of timber, with a pile and timber bulkhead extending 350 feet above and 1,400 feet below the structure. The Bow River at this point has a width of stream bed of about 500 feet and is maintained in its channel by high bluffs on the north, the south bank being low and subject to flooding at periods of extreme high water. The completed works consist of the concrete headgates for the canal, waterway for the weir structure, and a stop-log section across the river terminating in a dyke running up-stream along the south bank for a distance of 1,200 feet.

The headgates structure was completed during the winter of 1912-13. It consists of four sluiceways, some 20 ft. 6 ins. in width, having balanced steel Stoney gates operated by individual electric motors. A heavy scour mattress, 3 ft. 6 ins. thick, acts as the foundation, and there are wing walls of the gravity type, running well back into the embankment upstream and connecting with the pier for the weir down-stream. At the toe of the mattress there is a curtain of wooden sheet piling, and beneath the gates there is a core wall of heavy steel sheet piling. A reinforced concrete slab 10 ft. 6 ins. wide and 15 ft. above the gate sills provides a crossing. The gates have 5-inch diam. cast steel rollers operating on a 7-in. I-beam guide track, and are lifted vertically by 5 h.p. motors operating through gear and pinion.

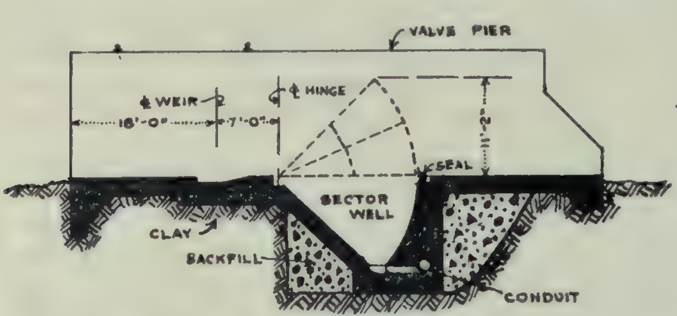


General section of stop-log dam, C.P.R. irrigation headworks.

The dam consists of a structure approximately 707 feet long face to face of abutments, a stop-log section of heavy concrete piers alternating with sluice openings with a length of 555 feet, and a movable steel sector dam 152 feet long, together with a dyke and breeching section along the south bank of the river to a point well above any possible amplitude limit. The stop-log section consists of 23 openings 20 ft. wide, founded on a heavy scour mattress with sheet pile cut-off wall, and carrying a reinforced concrete deck upon which travels an electric winch for handling the stop-logs. The trolley winch travels on 60-lb. steel rails on the deck, with three electric motors for performing its functions of traction, traversing, and raising or lowering the stop-logs. The stop-logs are 12-

in by 18-in. timbers, 21 ft. 11 in. long, eleven logs to each section, with cast iron slots in each end for the needles of the winch.

At the north end of the stop-log section is a long pier, extending 47 ft. up-stream from the stop-log dam, forming the south abutment for the weir and containing the inlet valve for the sector well. The adjacent pier extends 34 ft. up-stream, all the other piers extending but 14 ft. up-stream. The north abutment of the weir, adjoining the headgates structure, contains the discharge well. All the concrete construction is heavy mass work, the walls and piers being of the gravity type. The steel sector dam has a total length of 152 ft. and consists of a trussed steel frame conforming to the sector of a circle having a radius of 15 ft. 5 in., with a central angle of 45 deg. The curved surface and top deck have riveted water-tight skin-plates, and the whole is operated in a well below the stream-bed. The steel dam consists of fifty frames spaced 5 ft. on centres, connected by the skin-plates, and braced. The open ends are sealed against the masonry by a timber, held in place by spring bolts, pressing against the concrete surfaces. When the waterway is clear, the structure rests in a well below the stream-bed. Above and below the dam the well is protected by a heavy concrete scour mattress with up-stream curtain wall of triple timber sheet piling.



Section through sector well, C. P. R. irrigation headworks.

To operate, the stop-logs are placed in all sections, the head on the stop-log side of the longer valve pier becoming greater than that across the sector when no obstruction is offered. Water is then admitted into the sector well through a 24-inch valve in the pier, flowing through a 24-inch culvert with twelve branches 12 inches in diameter and opening into the sector well at regular intervals. As soon as the well has filled, the difference in head across the pier causes an upward pressure on the water-tight skin plates, operating to lift the sector. By placing a sufficient height of stop-logs, the difference in head may be maintained until such a point as may be desired, up to the full lift of the sector, or about 11 ft. 2 ins. The head on the inside of the sector is readily controlled through the discharge well in the north abutment. The water is discharged through a vertical weir tube operated by a hand wheel, controlling the discharge head, and hence the head on the sector. The annular weir consists of a cast iron tube 36 inches in diameter set below the river bed, supported through a reinforced concrete slab in a well formed in the abutment. In this telescopes a second tube balanced by a counterweight and operated by hand. Through this the water must pass to escape from the well, the maximum escape head being equal to that necessary to raise the sector to its extreme elevation.

Construction was commenced in the fall of 1913, but actual progress did not commence until January, 1915. Excavation was then commenced, and concreting was in progress day and night from the middle of February until completion in May. About 18,000 sq. ft. of cellular cofferdam was built, enclosing the sector well and abutments, and later portions of the stop-log section. In the sector well the excavation was in blue clay, almost bordering on rock, with occasional layers of sandstone 2 to 3 ft. thick. Because of the amount of water present and the low temperatures prevailing, it was necessary to handle practically the entire amount, about 10,000 cu. yds., by hand, loading into stone skips which were removed by derricks and dumped into 1½ cu. yd. cars in dinkey trains on a trestle to the bank. The concrete was placed from a switching track from a mixer plant located on the north bank. Three small Marsh-Capron mixers turned out about 2,500 cu. yds. of concrete a month. The erection of the steel sector was accomplished by setting up a wooden cofferdam around the sector well. Wooden sills were anchored to the scour mattress when concreted and held the toe of an A-frame, upon which were placed 2-in. planks for the outside of the cofferdam. There is a steel footbridge over the sector dam, and this was erected first. The frames for the sector proper were handled from this bridge.

The contractors for the dam were Janse Brothers, Boomer, Hughes & Crain, of Calgary, and the construction was under the immediate direction of Mr. A. M. Crain, Assoc. M. Am. Soc. C. E. The design was made by the Department of Natural Resources of the Canadian Pacific Railway (Mr. A. S. Dawson, Chief Engineer), and the entire work was carried out under the supervision of Mr. H. B. Muckleston, Assistant Chief Engineer.

To provide additional water supplies for the city of Hartford, Connecticut, a concrete dam is in course of construction on the Nepash River. The dam will be a solid wall of concrete 710 ft. long across the top, and in the centre of the gorge it will be 105 ft. thick at the base and will rise to a height of 130 ft. above the present bed of the stream. The top of the dam will be 25 ft. in width. After the reservoir has been filled the main road between Collinsville and Torrington will cross the top of the dam.

Sand is mixed with nearly all aggregates for the purpose of filling the voids. If enough sand is added to fill up the voids between the particles of aggregate added to fill the interstices between the sand, a much smaller quantity of cement is needed than if the sand be omitted, while at the same time a stronger, heavier, and more impervious concrete is obtained. Sand of uniform size tends to weaken the concrete, as also very fine sand. Uniformity in size means a greater proportion of voids, and either a larger quantity of cement has to be used to fill up the interstices or some remain unfilled to weaken the strength of the concrete.

Reinforced concrete is now being used in the construction of gasometer basins. A good example of construction of this kind is a circular basin which was recently built at St. Sebastian, Spain, and is the first example to be found in that country. The diameter is about 80 feet, and the height of the basin 26 feet. Around the basin are nine counterforts, each serving as the base for one of the steel stanchions of the framework which supports the gasholder.

Municipal Economy—How Legitimate Saving may be made Without Affecting the Public Health and Interest

By W. H. Maxwell, A.M. Inst. C.E., Borough Surveyor of Tunbridge Wells, Eng.

A new map of Europe, and of several other parts of the world, is now being worked out, and big historic events are being daily hammered into shape upon many a stubborn battlefield. Of no time in the past can it be more truly said that "history is in the making," for the records of "The Great War" which crashed in upon the Continent in August, 1914, to the surprise of all, except perhaps the Central European Powers, will assuredly stand out with a special prominence in the history of the world and of civilization to the end of time.

No parallel can be found for this great conflict with which fully to gauge its present significance, and no experience is available whereby its future consequences and limits can be predicted. This is well exemplified by the rapid development of the struggle. From what first appeared to be little more than local political differences between Serbia and Austria a European war suddenly evolved, which is now rapidly assuming the broader issue of a world-struggle by civilized humanity against an attempt at world domination by means of bare brute force, aided by every form of man-killing device modern science can produce.

The equipment for this twentieth-century war thus involves not only the placing and maintaining in the field of large masses of able-bodied, trained men, but also the utilization of an immense output of mechanical devices from engineering workshops and other manufacturing concerns requiring, in the aggregate, the diversion of huge sums of money from their accustomed channels.

"Nothing as Usual"

To meet this unprecedented drain, economies in numerous directions become essential, whether they be personal, domestic, municipal, or national, and the doubtful doctrine of "business as usual" must perforce give place to one of "nothing as usual."

Economy necessarily involves some sacrifice, and one of the first steps towards securing it is to take on that attitude of mind which enables a community to be satisfied with something less than was formerly considered needful. Neither war nor economy can be successfully waged when everything is expected to be "as usual," and as soon as this fact is fully realized the door is at once opened for possible reductions of expenditure. To many departments of municipal activity with which the present article is specially concerned, this condition is particularly apposite.

Life in towns conduces to the development of certain more or less artificial wants, which, on investigation, are oftentimes found to be by no means indispensible, and their abolition at once reduces expenditure while practical needful efficiency remains unimpaired.

The requirements in different towns vary according to their situation and local conditions, so that no absolutely hard-and-fast dividing line applicable to all cases can be drawn to separate the "luxuries" from the prosaic "necessities;" but, generally speaking, optional matters, such as parks and pleasure grounds, public music and other forms of entertainment, museums, and excessive street lighting afford ample scope for legitimate retrenchment without throwing any additional burden of expenditure upon succeeding years.

In the category of prosaic necessities may be included matters affecting the public health, sewerage, cleansing or scavenging of streets, house-refuse collection and disposal, public baths, water supply, and such like.

Careful discrimination should be made between cases of mere deferred expenditure and those which can be dispensed with altogether as being not essential. The postponement of absolutely necessary expenditure is not "economy," but frequently the reverse, and any indulgence therein will invariably build up a burden for succeeding years, with compound interest.

Throughout the country much municipal labor has been transferred for purposes of Government work, and also to augment H. M. Forces, and, in some cases, where suitable arrangements can be made, vacancies so caused need not be refilled during the temporary absence of employees, thus affording opportunities for economy.

In public parks, pleasure grounds, promenades and such like considerable economies are possible by the temporary sacrifice of nothing more serious than some degree of their customary stereotyped neatness and the discontinuance of the costly flowering of formal "beds" with the many accessory expenses necessarily involved.

Public music, and all other forms of entertainment, are out of harmony with the spirit of the times, when the soul of the nation is, or ought to be, concentrated upon business having for its object the furtherance of military and naval effort in every possible degree.

Another source of heavy expenditure is that of street lighting by means of powerful units of light, which enable the plan of a town and its principal buildings to be readily followed and located from above, thus providing convenient targets for hostile aircraft. Brilliant street illumination in war time cannot be looked upon as being either necessary or even desirable, while its discontinuance, if only in part, affords considerable scope for retrenchment. The saving under this head is one which can be made with the minimum of public inconvenience and without involving any question of deferred expenditure with which to burden succeeding years.

Public Health

In all matters of public health but little opportunity arises for curtailment of expenditure, except in cases where some item of wasteful or excessive expenditure is known to exist. Beyond this any material reduction is likely to prove to be false and expensive "economy," especially at a time like the present, when considerable numbers of soldiers are billeted in towns, and the maintenance of a high standard of public health is therefore of more than ordinary importance from a national as well as a local point of view.

There is probably no department of municipal expenditure in which the general public can assist the authorities more than in that of street cleaning or scavenging, inasmuch as the bulk of the refuse and litter to be removed arises from the very general practice of casting off of promiscuous rubbish into the public thoroughfares, including, for example, such litter as shop-sweepings, paper, loose outer packings dropped by tradesmen's delivery boys, banana skins, orange peel, handbills, torn correspondence, and other innumerable rubbish commonly, but illegally, thrown into the roadways.

Nothing perhaps more quickly gives a town a shabby, neglected appearance than streets besprinkled with such litter, but its daily collection and removal entails much avoidable expense in labour and cartage if the standard of cleanliness is to be maintained much above that of an Oriental city.

A statutory provision against the deposit of rubbish in streets has long existed, and its more general application would certainly afford an important source of economy. The enactment should be more widely made known.

The curtailment of expenditure in the maintenance and repair of highways can seldom be safely regarded as true economy, but is really only a deferred expenditure shelved at compound interest, for succeeding years. If needful repairs are too long postponed, in many cases the foundations of the roadways become weakened and so badly cut into and water-logged as to involve heavy expenditure in renewal, only to be avoided by the timely maintenance of the wearing surface or crust.

In suitable cases where a sufficient thickness of surface metalling is known to exist, some saving can sometimes be effected by scarifying up the worn surface, and again consolidating by rolling, with the addition of a small amount of road metalling of a similar quality. This will result in a saving of new material, while the labour will not be affected. At the present time economy of material is of first importance in view of its greatly enhanced price and difficulties of transit by rail. Haulage to the various roadways is also increasingly difficult and expensive, owing to the shortage of horses, tractors, and labor due to war requirements.

In the case of roadways of light residential traffic, culs-de-sac, and such like, considerable saving is possible by tar-painting the surfaces when in a good state of repair, as, under suitable conditions, such surfaces will give satisfaction for several years at little or no expense.

Tar-painting is a specially advantageous and economical mode of treatment on light-trafficked roadways as above and upon moderate gradients, as it prevents the disintegration of the roadway by excessive drought or heavy rain, stops the growth of weeds, and minimizes scavenging costs.

On roadways subjected to much traffic the saving is not so marked, as the coating of tar has a much shorter life, but even here there is an undoubted economy in road metalling and a welcome reduction of the dust trouble in fine weather.

In times past the provision of public baths has been criticized as a luxury, but, in view of recent experience on the sea, it is well to know how to swim. Even in the absence of such experience there is a great deal to be said in favour of the municipal bathing establishment. Not that such institutions can be regarded as sources of revenue showing well in a balance-sheet, but their educative and health-giving facilities are unquestionable. In towns where soldiers are billeted baths and swimming ponds are of special value just now, and are much appreciated by the men, who, of necessity, have limited facilities for personal cleanliness in an ordinary billet or camp. The health-giving properties of a well-kept public bath are of more than local importance, and no curtailment should be sought just now under that head. Like the majority of public health work, it is a case of "casting bread upon the waters with the hope of finding it after many days," but this can scarcely be expected to happen at the end of the current financial year.

The Cost of Loading Bricks into a Box Car by Means of a Portable Belt Conveyor*

THE following observations were made at a large brick manufactory in New Jersey, where common bricks were being loaded into a box car by means of a portable belt conveyor:

The car was on a siding and the bricks were (a) in piles about 30 ft. away; and (b) brought in on small flat cars on an industrial track parallel to and 40 ft. from the siding.

The conveyor was mounted on two wheels of about 4 ft. diameter and was driven by a small motor supported on the frame work. The belt was 20 ins. wide, 20 ft. long and had a speed of 240 ft. per minute. The lower end was 1½ ft. above the ground and the upper end 2 ft. above the car floor and extending about a foot within the car.

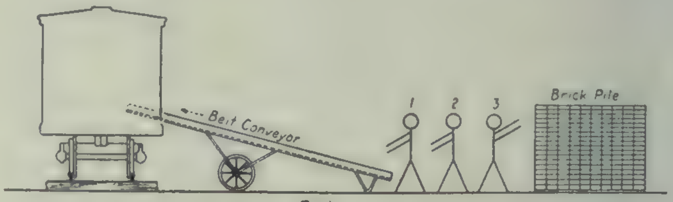


Fig.1

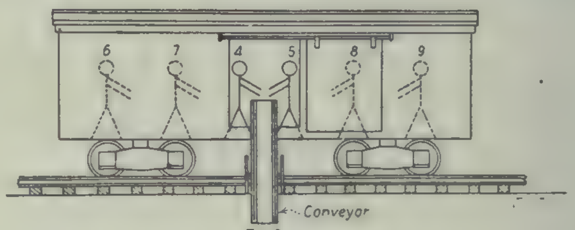


Fig 2

One man (1) (Fig. 1) stood at the foot of the conveyor and received bricks, four at a time, passed to him by two others (2) and (3) alternately, from the piles. (1) placed them on the conveyor and (4) and (5), standing in the car at the door, one on either side of the belt, took them off and passed them to (6) and (7) and to (8) and (9) who piled them in the car (Fig. 2).

From the flat Koppel cars which were run in as mentioned above, the bricks were loaded onto wheelbarrows, wheeled to the foot of the conveyor and stacked on four at a time.

The work was very fast and every unit was busy all the time. The only improvement that might have been suggested was that the bricks be placed with more uniformity on the conveyor. Sometimes they were put on in batches of four so close to one another that (4) and (5) could not get them off and they would pile up on the car floor. The foreman should have seen that the bricks were placed on the belt at equal intervals and with such frequency that the men in the car could just handle them.

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* By A. C. Haskell, New York City, in Engineering and Contracting.

The following time study was made when loading from the piles:

100 bricks were loaded in 1.07 mins.
102 bricks were loaded in 1.13 mins.
103 bricks were loaded in 1.17 mins.
100 bricks were loaded in 1.30 mins.

405 bricks were loaded in 4.67 mins.

On this basis in an 8-hour day, $\frac{405 \times 480}{4.67} = 41{,}600$ bricks would be loaded, which is between three and four car loads. Allowing 45 minutes for shifting the conveyor, etc., the total would be reduced to 37,700.

9 men at $1.75	$15.75
1 foreman at $3.50	3.50
Conveyor at $0.50	0.50
	$19.75

or $19.75 / 37.7 = 52.4 cts. / thousand.

Therefore to load a car with 12,000 bricks, which is about the average, would cost $6.30.

The following time study was made when they were unloading bricks from the flat Koppel cars with wheelbarrows and transporting them to the conveyor:

	Waiting at loading point. Min.	Loading barrow. Min.	Transporting loaded to conveyor. Min.	Unloading at conveyor. Min.	Transporting empty. Min.	
	0.07	0.72	0.12	1.30	0.13	
	0.28	0.70	0.10	1.73	0.08	
	0.07	1.08	0.10	1.65	0.10	
	0.17	1.55	0.12	0.90	0.07	
	0.00	0.67	0.58*	0.78	0.25	
	0.00	0.67	0.22	0.88	0.17	
	0.00	0.82	0.27	1.48	0.26	Total
Av'ge	0.08	0.89	0.22	1.25	0.13	2.57

*Includes delay en route.

The average number of men loading was two, and the average number of bricks loaded was 73. The distance to travel to the foot of the conveyor was 30 ft.

Average speed loaded = 30/0.22 = 136 ft. per minute.
Average speed empty = 30/0.13 230 ft. per minute.

On the above basis the total number of bricks handled per day by the three wheelbarrows would be:

$$\frac{480}{2.57} \times 3 \times 73 = 40{,}900$$

Allowing, as before, for time to shift, the number would be 37,000:

2 men loading at $1.75	$ 3.50
3 men transporting at $1.75	5.25
9 men at conveyor at $1.75	15.75
1 foreman at $3.50	3.50
Conveyor at $0.50	0.50
	$28.50

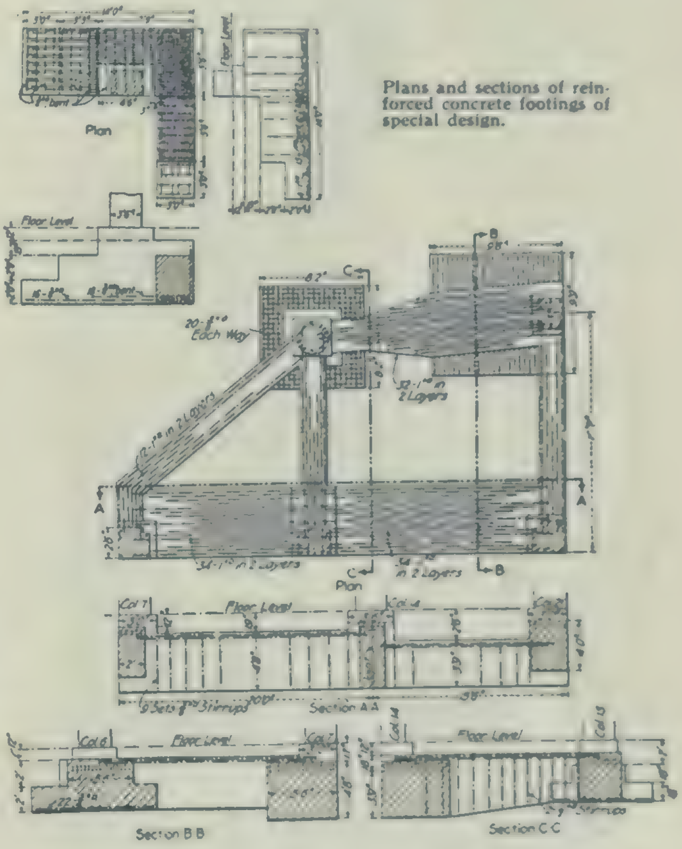
Or at a cost of $28.50/37.0 = 77.2 cts. per thousand, or at the rate of $9.25 per carload.

Reports from New York state that within the last few days additional large inquiries for steel have made their appearance in the market. The demand for steel for munitions is reaching unprecedented proportions. Canadian inquiries are for 35,000 tons of steel rounds.

Reinforced Concrete Footings of Special Construction

In solving the problem of supporting a corner column at a re-entrant angle and five columns at one corner of the new ten-storey storehouse being constructed for the Appleton Company at Lowell, Mass., two rather unique types of footing were used in order to keep within the lot lines. The owners required that all exterior footings be carried down 5 ft. below the sidewalk, while on one side the footings of the adjacent eight-storey storehouse are 6 ft. 3 ins. below the sidewalk, and the new footings had to be carried to the same depth. The solution of this problem (for the most interesting cases) is shown by the plans and sections herewith.

The building is designed for floor loads of 150 lbs.; the storey heights are 8 ft. except for the first floor, which is 13 ft. 3 ins. high. All footings are designed for a soil pressure of 8,000 lbs. per square foot, and in accordance with the report of test results in the Bulletin of the University of Illinois. The unit stresses used are those recommended by the Joint Committee.



Plans and sections of reinforced concrete footings of special design.

Footing at Re-entrant Angle

The unusual angle-shaped footing for the corner column was chosen because of its greater economy. The centre of gravity of the footing is under the centre of the column. The cantilever stresses at the projecting ends are provided for by the bending up of the tension steel and liberal reinforcement for shear.

The other footing, designed to carry five columns as shown, is also arranged to bring the centre of gravity of the total upward and downward forces vertically in line with each other. The long beam shown in elevation at section AA is designed as two simple beams, with the joint at column 14 as indicated. These straps are therefore all designed as simple beams with uniform loading.

These data were furnished The Engineering Record by E. F. Rockwood, Chief Engineer of the New England Construction Company of Boston, contractors for the building.

Tercentenary Monument for Quebec City

We reproduce a cut of a combined monument and fountain to be erected on Ronde de Chaine, near the Chateau Frontenac, Quebec City, to commemorate the tercentenary of the faith in Canada. The movement for the erection of the monument is under the direction of a committee of which the Hon. Thomas Chapais is president.

Proposed monument for Quebec City. To be erected in celebration of the R. C. faith in Canada.

The monument, 36 feet high, is to be of Stanstead granite, with decorations of an elaborate character, surmounted by a bronze statue, 9 feet high, representing "Faith." There will also be bas reliefs in brass representing various religious symbols. The foundations are of concrete. The statue and bas reliefs are to be cast in Europe, the entire monument costing $12,000. The work is to be carried out by Gaston Vennat and Company, of Montreal.

The relative merits of cast-iron and vitrified stoneware pipes for house sewer drains has been exhaustively investigated for a year by Mr. A. C. Shaver, chief sanitary inspector of the City Government of Passadena, Cal. The judgment of that body on their officer's report is in favor of the cast-iron pipe, and an order has been made to the effect that in future that pipe alone shall be employed. The conclusion arrived at is that cast-iron pipes can be made rootproof at the joints and can be thrown out of alignment without breaking.

Laying Sewer Pipe

The foundations in the trench should be formed to prevent any subsequent settlement and thereby a rupture of the pipes. If the natural foundation is rock it is recommended that an equalizing sand bed be placed upon the rock and well compacted by watering or otherwise so as to obviate irregular settlement. If the natural foundation is good firm earth, the earth should be pared or moulded to give a full support to the lower third of the pipe. Otherwise the bed should be made firm, either by sand well watered or rammed, or by a layer of cement mortar. The same means of securing a firm foundation should be adopted in case the excavation has been made slightly deeper than necessary.

When the sewer is to be laid in a concrete cradle, the concrete for the full width of the cradle should be continuously deposited to the height of the outside bottom of the pipe. Before the concrete has set the pipe shall be evenly bedded therein and the remainder of the concrete immediately placed on each side of the pipe and carefully tamped in such a manner as to avoid disturbing its position. Or the pipe may be supported and held in position by wedges or templates, and the concrete mixed wet, and poured under and around it in such a manner as to complete the cradle in one operation.

When the sewer is to be laid in a gravel or broken-stone cradle the material should consist of clean gravel or sound broken stone, all of which should preferably pass through a screen of 1-in. mesh and be retained on one of ⅛-in. mesh. The gravel or broken stone should be deposited and consolidated for the full width of the trench to the height of the outside bottom of the pipe. The pipe should then be bedded therein and the remainder of the gravel or broken stone deposited and carefully consolidated in such a manner as to avoid disturbing the position of the pipe. The cradles should in all cases be so constructed that an undue proportion of the load shall not be borne by the hubs.

If the trench is situated in ground water, it is recommended to lay the pipe in a concrete cradle up to the springing line.

When a sewer is to be laid without a cradle the earth forming the bed should be carefully freed from stones and organic material. The pipe should then be evenly bedded therein, the joints tamped in such a manner as to avoid disturbing the position of the pipe.

When pipe is to be laid in new embankment the fill-up to a point over the springing line of the pipe should be deposited in layers not exceeding 6 ins. and thoroughly consolidated by rolling, ramming, teaming, watering, or a combination of these, depending upon the nature of the filling material, whether it is clay, sand, gravel, or a mixture of these.

If a pipe line is situated on one side of an embankment where the soil is liable to lateral movements, and is thus subjected to a one-sided load or pressure, care must be taken to secure a stable foundation, so that the pipe line will not be moved on its bed. A retaining support should be placed at the side having the less pressure. It should be made of suitable material, of proper height and weight, to transfer to the foundation the excessive lateral earth pressure, without danger to the stability of the pipe line.

Trenches should be kept free from water until the material in the pipe joints has hardened sufficiently so that the pipe line will be continuous and strong.

The stresses produced in pipe by the back-filling will differ according to the conditions of the soil. In self-sustaining soil it is possible to lay pipe at a considerable depth without producing excessive stresses. In soil which permits of lateral movement, or which is water-carrying, special precautions are necessary.

To protect pipe lines from unusual stresses all work should be done in open trenches. Tunnelling should be prohibited, except with the special consent of the engineer.

Pipe lines should be placed at such a depth below the surface of the street that dangerous pressure or impact cannot occur. If it is not possible to do this, special reinforcement is required.

Rock excavation should be made to a depth of at least 4 ins. below the outside bottom of the pipe, or as shown on the plan.

Width of trenches in earth should be sufficient to provide a free working space of from 6 to 12 ins., exclusive of spurs and hubs, according to the size of the pipe and the character of the ground.

The width of trenches in rock should be sufficient to provide a free working space of 12 ins. on each side of the pipe, exclusive of spurs and hubs.

In every case there should be sufficient space between the pipes and the sides of the trench to make it possible to thoroughly ram the back-filling around the pipe and to secure tight joints.

If soil conditions and ground water require the use of sheeting, sheet piling and bracing, the trenches should be made correspondingly wider. The sheeting should be closely driven, and to such depths as the soil conditions may indicate.

Steel sheeting may be used with advantage where the flow of ground water into the trenches is excessive and the stability of the foundation soil and of the sewer is affected thereby.

Where a trench for a proposed sewer or extension of a sewer terminates in rock, it should be excavated for a distance of not less than 5 feet beyond the end of the sewer in the direction of the proposed extension. The pipes and all other structures should be carefully protected from the effects of blasts.

Pipe Laying

The laying of pipes in finished trenches should be commenced at the lowest point, so that the spigot end points in the direction of flow.

All pipes should be laid with ends abutting and true to line and grade. They should be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Unless otherwise permitted or directed, not less than 20 feet of pipe sewer should be laid in one operation.

It is necessary to use all possible care when shoving the pipes together, so that mortar will not be shoved into the hub or the joint be unnecessarily large.

Sockets should be carefully cleaned before pipes are lowered into trenches. The pipe should be so lowered as to avoid unnecessary handling in the trench. After the ends of the pipes have been sufficiently welded, the hub end should receive upon its lower half a layer of mortar composed of 1 part of Portland cement to 1 or 2 parts of fine sand.

The pipe should be set firmly according to line and grade, and the joint carefully adjusted, filled with mortar and finished to a smooth bevel outside. The inside of the pipes should be then cleaned of dirt and mortar refuse. In small pipes the inside should be made smooth by a hand swab. Large pipes should be laid with block and tackle, and bar and tongs.

Gasket and mortar joints should be made in the following manner: a closely twisted hemp or oakum gasket of suitable diameter, in no case less than ¾ in., and in one piece of sufficient length to pass around the pipe and lap at the top, should be solidly rammed into the annular space between the pipes with a suitable caulking tool. Before being placed the gasket should be saturated with neat cement grout. The remainder of the space should then be completely filled with plastic mortar mixed 1:1, and the joint wiped inside and finished to a smooth bevel outside.

Where butt or bevel joint pipes are used, the following method of joining is recommended: after a layer of mortar about 8 ins. wide has been prepared at the joints, a wire netting is spread upon the same and covered with a layer of mortar about 1 in. thick. Upon this wire netting, which is embedded in the mortar, forming a bandage, the pipes are laid and adjusted according to line and grade. The bandage is then raised on both sides of the pipe, bound at the top, and covered with a layer of strong cement mortar at least 2 ins. thick. The inside of the joint is finished in the same manner as specified for hub-and-spigot pipes.

The ends of pipes which enter masonry should be neatly cut to fit the face of the masonry.

No pipe or the cradle thereof should be laid or placed until the sub-grade of the trench has been tested and found correct.

In deep cuts, in high embankments, or in poor soil, it is recommended to use especially strong pipes or concrete reinforcement.

The smaller sizes of cement or concrete pipes should preferably have flat bases. If of sufficiently large diameter, they may be reinforced.

When mortar or concrete are to be mixed or placed in freezing weather, the following precautions are advised: No concrete should be laid when the temperature of the air is below 24 deg. Fahr. When the temperature is between 24 and 32 deg. Fahr., and rising, the mixing water should be heated to a suitable temperature, or, if directed, 1 per cent. of salt, by weight, should be added for each degree of Fahrenheit of air temperature below 32 deg. Fahr. Under such conditions other materials for concrete and mortar should all be heated.

Back-Filling Trenches

All trenches and excavations should be back-filled immediately after the pipes are laid therein, unless otherwise directed. The back-filling material should be selected and deposited with special reference to the future safety of the pipes. Clean earth, sand, or rock dust should be used up to a level at least 2 ft. above the top of the pipe. This material should be carefully deposited in uniform layers about 6 ins. in depth. Unless otherwise permitted, each layer should be carefully and solidly tamped or rammed with proper tools, so as not to injure or disturb the pipe line. The back-filling material for the remainder of the trenches should contain no stone over 10 ins. in their largest dimensions, should be spread in layers, and thoroughly consolidated by tamping or otherwise as the engineer might direct. Stones which are used in back-filling should be so deposited through the mass that all interstices are filled with fine material.

Where the safety and stability of the pipe line and other structures render it necessary, sheeting should be left in place, particularly below the top of the pipe.

When sheeting is withdrawn, all cavities remaining or adjoining the trench should be solidly filled. When the sheeting is left in place, all cavities behind such sheeting should be solidly filled.

For retaining back-filling temporarily, timber bulkheads may be used. They should be removed as the trenches are back-filled.

Puddling or water flooding for consolidating the back-filling is recommended only for sandy and gravelly materials. If this method is used, then the first flooding should be applied after the back-filling has been compacted by tamping up to the springing line of the pipe, and the second flooding during or after the subsequent filling of the trench. An excess of water should be avoided, in order to prevent disturbance of the earth under and around the pipe, and also to prevent an undue excess of pressure on the pipe.

Walking or working on the completed sewer, except as may be necessary in tamping or back-filling, should not be permitted until the trench has been back-filled to a height of at least 2 ft. over the top of the pipe.

Where a one-sided pressure exists, due to unbalanced loading, the filling of the trench should be carried on simultaneously on both sides and in such a manner that injurious side pressures do not occur.

In freezing weather back-filling should not contain any frozen lumps of earth below a level at least 2 ft. above the top of the pipe.

Officially-Recommended Spelling and Definitions of Important Road-Building Terms

(Conclusion)

Refined Tar—†A tar freed from water by evaporation or distillation which is continued until the residue is of desired consistency, or a product produced by fluxing tar residuum with tar distillate.

Renewals—Extensive repairs over practically the whole surface of the metalled or paved portion of the highway.

Repairs—The restoration or mending of a considerable amount of the metalled or paved portions of the highway, but not usually of a majority of the surface area. More extensive than "Patching," but less so than "Renewals."

Resurfacing—The renewal of the surface of the crust or pavement.

Road—A highway outside of an urban district.

Road-Bed—The natural foundation of a roadway.

Road Metal—Broken stone, gravel, slag, or similar material used in road and pavement construction and maintenance.

Roadway—That portion of a highway particularly devoted to the use of vehicles.

Rock Asphalt—Sandstone or limestone naturally impregnated with asphalt.

Rock Asphalt Pavement—A wearing course composed of broken or pulverized rock asphalt, with or without the addition of other bituminous materials.

Sand—Finely divided rock detritus the particles of which will pass a 10-mesh and be retained on a 200-mesh screen. Also see "Gravel."

Sand-Clay Road—A roadway composed of an intimate mixture of sand and clay.

Scarify—To loosen and disturb superficially.

Screen—In laboratory work, an apparatus in which the apertures are circular, for separating sizes of material.

Screenings—Broken rock of a size that will pass through a ½- to ¾-in. screen, depending on the character of the stone.

Seal Coat—A final superficial application of bituminous material during construction, to a bituminous pavement.

Setting Up—The relatively quick change such as takes place in a bituminous material after its application to a roadway, indicated by its hardening after cooling and exposure to atmospheric and traffic conditions, as opposed to the slower changes later occurring gradually and almost imperceptibly.

Shaping—Trimming up and preparing a sub-grade preparatory to applying the first course of the road metal or artificial foundation.

Sheet-Ashalt Pavement—One having a wearing course composed of asphalt, cement, and sand of predetermined grading, with or without the addition of fine material, incorporated together by mixing methods.

Sheet Pavement—A pavement free from frequent joints such as would accompany small slabs or blocks, and which has an appreciable thickness (say, in excess of 1 in. on the average) for its wearing course.

Shoulders—The portion of the highway between the edges of the road metal or pavement and the gutters, slopes, or water-courses.

Side Drains—See "Drainage."

Sidewalk—The portion of the highway reserved for pedestrians.

Sieve—In laboratory work, an apparatus in which the apertures are rectangular, for separating sizes of material.

Silt—Naturally deposited fine earthy material which will pass a 200-mesh sieve. Also see "Grravel."

Spalls—Fragments broken off by a blow, irregular in shape, and of sufficient size to be comparable to the original mass.

Squeegee—A tool with a rubber or leather edge for scraping or cleaning hard surfaces, or for spreading and distributing liquid material over and into the superficial interstices of roadways.

Squeegee Coat—An application by means of the squeegee.

Stone Block Pavement—One having a wearing course composed of stone blocks quite or nearly rectangular in shape.

Street—A highway in an urban district.

Sub-Grade—The upper surface of the native foundation on which is placed the road metal or the artificial foundation, in case the latter is provided.

Superficial Coat—A light surface coat.

Surface Coat—See "Carpet."

Surfacing—(1) The crust or pavement. (2) Constructing a crust or pavement. (3) Finally finishing the surface of a roadway. (4) Treating the surface of a finished roadway with a bituminous material.

Surface Treatment—Treating the finished surface of a roadway with bituminous material.

Tailings—Stones which, after going through the crusher, do not pass through the largest openings of the screens.

Tar—†Bitumen which yields pitch upon fractional distillation, and which is produced as a distillate by the destructive distillation of bitumens, pyro-bitumens, or organic material.

Telford—Properly an artificial foundation advocated by Thomas Telford (1757-1820), and consisting of a pavement of stone about 8 in. thick, laid by hand and closely packed and wedged together. The individual stones were desired to be about 16 sq. in. in section, and about 8 in. in length. They were set close together on the prepared sub-grade, their longest dimension vertical and on their larger ends, their interstices chinked with smaller stones, and the whole rammed (or rolled) until firm and unyielding.

Telford Macadam—Macadam with an artificial foundation of Telford.

Under-Drain—See "Drainage."

Upkeep—Maintenance.

V-Drain—See "Drainage."

Viscosity—The degree of fluidity of bituminous materials.

Volatile—Applied to those fractions of bituminous materials which will evaporate at climatic temperatures.

Water-Bound—Bound or bonded with the aid of water.

Water-Gas Tars—Tars produced by cracking oil vapors in the manufacture of carbureted water gas.

Wearing Coat—The superficial layer of the crust or pavement exposed to traffic.

Wearing Course—The course of the crust or pavement exposed to traffic.

Wood Block Pavement—One having a wearing course composed of wood paving blocks, generally rectangular in shape.

Maintenance, Materials and Methods of Road Work[*]

By A. W. Dean[†]

THE date of the completion of the construction of a roadway surface marks the date when maintenance must commence. The materials and methods to be used are governed by the type of the constructed surface; the urgency for prompt attention to maintenance is governed by the type of surface and by the quantity and quality of vehicular traffic; the cost of maintenance is governed primarily by the judgment used in selecting the types of surface for the roadway when constructing it. Too often necessity requires the construction of an inferior surface where a paved surface should be laid, thus permitting a temporary economy in construction that is soon balanced by an excessive charge for maintenance and renewal.

Maintenance is brought to its lowest terms when the roadway surface has been properly designed and constructed. A properly-built roadway is that which has been properly designed to withstand existing and anticipated traffic and other conditions, and built with good quality of material and workmanship. If all roadways were so built, the maintenance problem would cease to be a problem, and there would be little occasion for conventions and discussions by road makers. This condition will never be reached, however, and for generations to come we shall have the countless problems of maintenance to solve.

The terms "maintenance" and "repair," while not entirely synonymous, will, however, be considered as such herein, in order to permit as broad a treatment of the subject as possible in the fewest words.

Earth Road Maintenance

The prevailing obstacle to proper maintenance of earth roads is lack of surface and sub-drainage. Surface drainage should be provided for by constructing and maintaining the roadway with proper and sufficient crown, and by providing proper side-drains, or gutters and culverts. When built on a long steep grade on a side hill, culverts should be placed frequently to carry the water across and under the road rather than (as is quite common) constructing so-called water bars to carry the water across and above the surface of the road. A grader or road machine should be used on earth roadways not more than twice a year, and preferably not more than once a year. It should be used with care. If sods and improper material have accumulated on the edges of the roadway, and are pulled over to the surface of the road by the grader, they should immediately be carted away from the surface. A road drag is almost indispensable in the maintenance of a proper surface on an earth roadway. The drag should be used frequently and when the earth is moist. It is of no value when the earth is very dry, and it is of little value when wet. The drag will not fill large depressions, such as occur at each end of a bridge, but it will keep the roadway in fairly good condition for travel at all times if properly used. Where large depressions occur in a roadway it is not good practice to place broken stone or coarse gravel into such depressions, as such practice has a tendency to cause a hard section with a hole at each end.

Sand-Clay Roads

Roads constructed with a mixture of sand and clay (sand-clay) may be considered as earth roads in an advanced stage. The ordinary maintenance of sand-clay roadways is best effected in the same manner as earth roadways. Where soft mud holes occur in sand-clay roadways, it is advisable to fill such places with sand, as in general such holes are caused by an excess of clay in the mixture. Often such roadways are not constructed with the right proportions of sand and clay in the original mixture, and maintenance will depend upon the conditions due to the excess of one material or the other. If the entire surface is quite soft, and ruts badly during wet weather, it is evidence that there is an excess of clay; therefore, in the maintenance of the roadway under such conditions, a thin layer of sand should be spread over the surface, and if the conditions are sufficiently bad to warrant it, the sand should be harrowed into the surface. On the other hand, if the surface does not become compact, but rather shows indications of being sandy, a small quantity of clay should be spread upon the surface. As in the case of the ordinary roadway, proper surface and sub-drainage should be provided to take care of the excess of surface and ground water.

Gravel Surfaces

Gravel surfaces are frequently maintained to a certain extent by the use of the drag. A road machine should not be used on gravel surfaces except when it is desired to widen the travelled way or to smooth the surface lightly. Whenever a road machine is used on a gravel roadway for widening the travelled section, great care should be taken to remove from the surface any material other than gravel that may be brought on by the use of the machine. Ruts or depressions occurring in a gravel roadway should be repaired by filling lightly with gravel as near the same quality as that originally used in the surface as is obtainable. Maintenance of a gravel roadway is greatly assisted by applying uniformly at the rate of about one-half gallon to the square yard once each year an asphaltic oil of about the maximum consistency that can properly be spread at air temperature with a common distributor. Such application not only furnishes a small amount of binder for the upper surface, but prevents the dispersion of the surface in the form of dust. The gravel surface herein referred to consists of material in which the mixture of round stones and particles is quite uniformly variable in size from minute particles to stones two or three inches in diameter. This definition is given on account of the fact that there are so many different ideas conveyed when the term gravel surface is mentioned.

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The Water-bound Macadam Type

Maintenance of a broken stone macadam (water-bound macadam roadway) whenever constructed by the usual method is a more or less difficult problem, depending upon the traffic that it has to withstand. If the traffic consists largely of steel-tyred vehicles, with very few rapidly-driven motor vehicles, a macadam roadway may be maintained by keeping its surface covered with a light layer of sand or other suitable fine material, the object of this covering being to keep sufficient binder on the surface to prevent the stones in the surface from picking up. If, however, the traffic is sufficient to wear out the surface rapidly, as is the case when there are many motor-driven vehicles, the sand surface cannot be maintained, and it becomes necessary to use some other means of maintenance. The use of a bituminous binder in the construction and maintenance of macadam roadways has now become quite universal, and the problem of maintenance of bituminous-bound or surfaced roadways has now become simple.

Applying about one-half gallon to the square yard of an asphaltic oil or refined tar at proper intervals permits of maintenance of macadam roadways under ordinary traffic for a long period, provided the subsequent applications are made at proper intervals. The interval between applications cannot be definitely stated; it can only be determined by the appearance of the surface of the roadway. In Massachusetts it has been the practice for several years to maintain water-bound macadam roadways by surface applications of so-called "cold oil," the oil used being what is termed by the manufacturers as "50 per cent. oil." It has been found that one application a year is sufficient on most of the roadways where maintenance is effected in this manner. The method of applying the oil is as follows: first, the road is swept lightly to remove all surplus material from the surface. The oil is then applied by means of a pressure distributor, thus ensuring a complete and uniform covering. Immediately thereafter, coarse sand is spread in sufficient quantity to entirely cover the oil. The amount of oil used in the first application is approximately one-half gallon to the square yard, and on subsequent applications the amount varies from one-fifth to one-third of a gallon to the square yard. The asphalt contained in this oil forms a thin carpet on the macadam surface and not only prevents wear but prevents distribution of dust. It has been found that the use of heavy oils, such as are known to the trade as "90 per cent. oils," assist in a satisfactory maintenance for only one or two years, after which the bituminous material has a tendency to crawl and become wavy. The lighter oils, having less body, do not have this objection. Refined tar is often used in the same manner as described above in the maintenance of macadam roadways, and often gives quite satisfactory results.

Repairs on a Bituminous Blanket

Repairs on a bituminous blanket or thin surface coat may be made by covering the section to be repaired with a thin coat of asphaltic oil or tar, as the case may be, and immediately covering with pea stone, fine gravel or coarse sand. This is assuming that the repairs consist of renewing comparatively small sections of the coating that for any reason may have disappeared. No general fixed method can be described for making repairs due to imperfect workmanship, the use of too much bituminous material, or the irregular distribution of material, each case having to be treated in such a manner as experience may have to be best. Ordinarily, renewals of bituminous carpets may be made by a repetition of the usual process of constructing such carpets, except that it is advisable always to use less bituminous material per square yard for renewal than was used in the original carpet.

So-called sand and oil-mixed road surfaces are either repaired or renewed by the addition of mixed material of the same quality and density as that used in the original surface.

Bituminous grouted or mixed macadam surfaces should not require early or frequent repairs or renewals if designed and constructed properly in the first instance. Should the necessity for repairs arise, however, they are ordinarily made by the removal of all disintegrated or imperfect portions of the surface, and substituting a mixture of bitumen and small broken stone, the mixture being made either by mixing previous to application or by spreading stone and filling the voids by pouring. In renewing bituminous macadam surfaces it is not generally necessary to break up or remove any of the existing surface; the new surface may be added by spreading directly over the old surface. If, however, the old surface in addition to having become worn thin is worn very irregularly, it is advisable to loosen up, scarify, re-shape and roll the old surface before adding the new surface material.

Cement-Concrete Surfaces

The repair of cement-concrete surfaces is a comparatively new problem, as such surfaces have not been in use for many years, and such repairs as have been required have been due to imperfect workmanship or material. If the defects to be repaired consist of badly-disintegrated sections, they cannot be permanently repaired except by the removal of all material in the sections to the full depth of the surface, replacing with new and proper concrete. If the defects to be repaired are minor, however, and consist merely of small depressions, they may be repaired by filling the depressions with a bituminous mixture. When a cement-concrete surface becomes worn sufficiently to appear to require renewal, it is impossible to renew it by adding a new thin coat of cement-concrete mixture; therefore, it may be said that a cement-concrete surface cannot be renewed with the same type of surface, but must be entirely removed and a new section constructed. This would be expensive, however, and it appears that the proper method of bringing up an old concrete surface is to cover it with a bituminous-bound surface in place of a cement-concrete surface.

Block pavements of all kinds can be repaired or renewed only by the entire removal and replacement of the sections.

Resurfacing Old Roads*

By William D. Uhler†

THE essential points to be considered in the selection of a proper type of surface for an old stone road are the character and amount of traffic, the grades, and, as a rule, that most important factor, the funds available for the work. When the traffic has been determined and the character of surfacing selected a thorough study should be made of the existing foundation and drainage facilities. Many surfaces have been sacrificed for the want of proper attention to the foundation, and too often it is taken for granted that any stone road is a suitable base for almost any type of surface. Test-holes should be made at sufficient intervals in the road to determine the depth of the existing foundation. Usually it is found that a considerable portion must be restored before a surface can be applied. Irrespective of the type of surface selected, the preparation of the foundation must be given the same careful attention. Too much stress cannot be laid on the desirability of having proper lines and grades before resurfacing, in order to avoid increasing or perpetuating the difficulties of the future improvement of these roads. The question of providing proper under-drainage must be considered and drains installed where necessary.

In order that the various methods to be employed can be described conveniently, the subject will be divided into the following classifications: first, water-bound and bituminous macadam; second, bituminous-concrete and sheet asphalt; third, vitrified or other block pavements.

The methods used in the preparation of the base for both water-bound and bituminous macadam are the same. If any holes or depressions are found in the base, the road should be dug out and replaced with good sized clean stone, keyed with a smaller size, and rolled with a ten-ton power roller until thoroughly compacted. The roadway should then be cleaned thoroughly and the existing surface broken or loosened with picks, harrows, or, if necessary, rollers equipped with spikes so that the new material will bind properly with the old surface. Where the new surface is wider than the old base or where, in improving the lines, it rests partly on the old surface and partly on the old shoulder, it is necessary to provide a new first course or a base where an old one does not exist, in order to support properly the top layer or wearing surface.

After the base course has been finished, there should be laid a layer of properly graded, approved stone, passing a two and one-half inch mesh screen, and being retained on a one-third mesh screen, this stone being known as "1½-inch stone." The stone should be spread upon the base course with shovels, from piles along the side of the road or from a dumping board, but in no case should the stone be dumped upon the first course surface. This layer should be rolled with a roller weighing not less than ten tons until it is compacted to a firm and even surface. The total thickness of the surface course should be not less than three or four

Panoramic view of Winnipeg's wholesale section.

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inches after rolling. When a surface course of a depth of three inches is specified it should be laid in one layer, and a 4-inch course should be laid in two layers of two inches each.

Should difficulty be experienced while rolling in getting the stone to compact thoroughly, sprinkling with water or spreading lightly with screenings will prove beneficial.

After the surface course of stone has been thoroughly rolled, screenings, varying in size from dust to ¾ inch, should be spread with shovels from piles along the side of the road, or from dumping boards; but, again, in no case should the screenings be dumped directly upon the surface of the stone. These screenings should then be thoroughly rolled with a ten-ton steam roller, additional dry screenings applied, and the rolling continued without the use of water until the interstices of the stones are filled. The road should then be sprinkled with water, rolled, additional screenings spread, and the sprinkling and rolling continued until the surface is well-bonded and set. In all cases the rolling should begin at the sides and work toward the centre of the roadway, thoroughly covering the area with the rear wheels of the roller, and should be continued until the surface is hard and smooth, and shows no perceptible tracks from vehicles passing over it.

To protect a water-bound macadam road from the ravages of automobile traffic it should be given a bituminous surface treatment of either approved tar or asphalt. Prior to applying this bituminous material, the surface of the road should be cleaned thoroughly, by sweeping with machine and hand brooms. After all the caked dust has been scraped off and the stone has been exposed uniformly over the surface, the bituminous material should be applied.

Bituminous Macadam

In resurfacing with bituminous macadam, the base course should be prepared as for water-bound macadam, after which broken stone passing a two and one-half inch screen and retained on a one-inch screen should be spread upon the base course with shovels from piles along the side of the road, or from a dumping board, to a depth of three inches after rolling. After the broken stone has been laid and placed true to line and grade and cross-section, it should be rolled—with a roller weighing not less than ten tons—until the stone has been thoroughly compacted and ceases to creep in front of the roller. When the rolling has been finished, there should be spread evenly over the surface a quantity of approved bituminous binder, not less than 1½ nor more than 1¾ gallons to each square yard of surface area. The binder should be heated to the proper temperature for the material used.

After the bituminous binder has been applied, there should be spread a layer of ¾-inch dry, crushed, approved stone, free from dust, and in such quantity as will just cover the surface and fill the surface voids. Rolling should be continued until the surface is thoroughly bonded; the surface then should be swept clean of all loose stone and an application of bituminous binder, of approximately one-half gallon to the square yard of surface area, applied evenly. This binder, in turn, should be covered immediately with a thin layer of dry stone chips, free from dust and rolled lightly. The quantity of chips should be just sufficient to absorb the excess of bituminous material remaining on the surface and to prevent the existence on the surface of an excess of binder.

Bituminous Concrete and Sheet Asphalt Resurfacing

Bituminous concrete and sheet asphalt pavements should be laid on a concrete base, instead of on the old existing macadam foundation which, heretofore, has been the generally accepted practice for country roads.

In view of the increased amount and change in character of traffic, even though slightly more expensive, it is advisable to provide for either a 4-inch or a 5-inch concrete base on top of the broken stone or telford base, due to the tendency of macadam to shift or to consolidate further under traffic and possible sub-grade trouble, all of which tends to bring about a wavy or uneven condition of the surface.

In resurfacing old water-bound macadam roads, where the base consists of either telford or macadam, the broken stone surface should be removed to a depth sufficient to conform to the required cross-section and grade. Where the telford surface is exposed, the irregularities are broken off with a napping hammer and the depressions filled in. Upon this prepared surface is placed a 4-inch concrete base, mixed in the proportion of 1:3:6, laid so as to secure a very rough but regular surface to form a bond between the concrete base and the bituminous top. In conjunction with the concrete base a concrete header curb should be constructed extending six inches beyond the fixed edges of the bituminous pavement and to the finished grade. After the concrete base has developed a hard set, and from one to two days prior to the placing of the bituminous wearing surface, the base should be cleaned thoroughly of loose and foreign material by sweeping, and then covered with an asphaltic cut-back mixture consisting of equal parts, by volume, of asphaltic cement, 55 to 65 penetration, and commercial naphtha, 52 to 55 gravity, the mixture being applied by a pressure distributor at the rate of one-eighth gallon to the square yard. The object of this paint coat is to secure a better bond between the concrete base and the bituminous top. The bituminous top, two inches in thickness, is laid under the same requirement as to preparation, laying, rolling and inspection as for a standard sheet asphalt pavement.

The following penetrations are recommended for the asphaltic cement:

	Heavy Team or Motor Traffic	Medium or Light Traffic
Trinidad Asphalt	45-50 penet'n.	50-55 penet'n.
Bermudez, Mexican and California	50-55 penet'n.	55-60 penet'n.

Experience has demonstrated that the turning of traffic on and off a bituminous surface will result in grinding or cracking the edges and also, unless a perfect bond has been secured with the base—and this cannot be relied upon—heavy wheel loads, at a distance of one to two feet from the edge, will produce a spreading of the bituminous surface. To prevent this, provision should be made, no matter what the formation may be, for a 6-inch concrete header curb on either side of the road if it is not paved to the full width.

Unquestionably the most important single point in the laying of sheet asphalt wearing surface is the rolling. More pavements are failing to-day through displacement from original form than from all other causes combined, and aside from the other reasons to which this result may be attributed—and there are undoubtedly many—it is certain that unless a pavement is free from waves at the time of completion it never will be, as the tendency of the pavement is to push under traffic, thus increasing the wavy condition. It is important, therefore, that all pavements be thoroughly compressed, carefully rolled and cross-rolled.

In the preparation of bituminous mixtures all materials should be subjected to rigid plant and laboratory inspection.

Vitrified and Other Block Pavements

Where the character of traffic demands block pavements, it is poor practice to lay them on other than a stable foundation. Under these circumstances, it is, as a rule, more economical to use either a 5-inch or 6-inch concrete base, the depth depending upon the character and volume of traffic for which it is designed. If a concrete base is used, it should be laid true to line, grade and cross-section, after which a sand cushion should be spread to a uniform depth of from one inch to one and one-half inches. This cushion should be shaped carefully, to a true cross-section, by means of a templet having a steel faced edge covering at least half the width of the area to be paved. The cushion should then be moistened slightly and rolled over its entire surface with a hand roller. After rolling the templet should be drawn over the surface again to shape the cushion finally.

The blocks meeting the required test should be laid on edge in straight rows at right angles to the curb, except at intersections, which should be paved at an angle of 45 degrees to the centre lines of the intersecting roadways. After the blocks, as laid, have been inspected and approved for rolling, and the surface has been swept clean, the pavement should be rolled with a self-propelled roller, weighing not less than three nor more than five tons. The rolling should commence at the edge and continue back and forth toward the centre until the centre of the roadway is reached, then the opposite side should be rolled in a like manner. The pavement should then be rolled transversely at an angle of 45 degrees, repeating the operation in the opposite direction. Before and after this rolling has taken place, all broken or injured blocks should be removed and replaced.

After thorough rolling the joints should be filled with grout, composed of one part clean sand and one part Portland cement. Special attention must be paid to the mixing and placing of the grout. Soon after the joints have been grouted and the cement filler has set, the expansion joints next to the curb should be poured. Attention also should be paid to securing a proper bituminous filler, which will not be too brittle in winter nor too soft in summer.

The same general practice as here outlined for vitrified block pavement is applicable to a more or less extent in the laying of either granite or wood block, the difference being, as a rule, that in the laying of granite block the sand cushion is from one and one-half to two inches in depth. The blocks should be sorted and gauged, those of the same width and depth being paved in consecutive rows across the full width of the road and rammed with hand rammers instead of being rolled, after which they should be grouted with a cement grout.

In paving with wood block a layer of mixed sand and cement one inch in thickness, mixed dry in the proportion of one part of Portland cement to four parts of sand, should be spread upon the base and brought to a surface parallel to the grade and contour of the finished pavement.

Prior to the laying of the wood blocks this cushion of sand and cement should be sprinkled lightly with clean water and the blocks immediately set thereon. Care should be taken to set the blocks with the fibre of the wood vertical, in straight parallel courses, at right angles to the curb. After laying, the blocks should be rolled with a self-propelled roller weighing not less than three nor more than five tons and the joints then filled with fine, clean, dry sand passing a ten mesh sieve.

No attempt has been made to give in detail the specifications for all classes of material entering into the various methods of resurfacing, as this information can be obtained from any of the standards now in use.

The foregoing description, however, covers in general the methods employed in resurfacing work, but in order that the best results may be obtained, there are several points which should be emphasized in summarizing the subject.

In the resurfacing of water-bound macadam it is frequently the case that the engineer in charge of the work allows too small a stone to be used, which, it is true, will require decidedly less rolling but will not stand the motor traffic of to-day.

Another fault quite often found is the spreading of screenings before the one and one-half inch stone is thoroughly locked, and very frequently using too large quantities of screenings, thereby causing a heavy crust to form on the road surface.

The success of the bituminous treatment of water-bound macadam roads depends entirely upon the cleanliness of the road before the application of the material. Many failures are due to the lack of proper care in this most important detail. In cleaning the surface of the road, the sweeping should be windrowed along the edges of the wearing surface in order to prevent the running off of the bituminous material, which later should be swept back on the road. Special attention should also be given to the applying of the chips, just sufficient chips being used to prevent the traffic from picking up the bituminous material.

In bituminous macadam or penetration work, no bituminous binder should be applied unless the stone surface is thoroughly dry, and the temperatura of the air is 65 degrees or higher, and special attention paid to the heating and applying of the binder.

One of the important features in connection with obtaining the best results in bituminous concrete construction is the use in the wearing surface of good, hard, durable stone, free from dirt and decomposed material, as decomposed stone in the mixture will naturally develop weak spots in the pavement and ultimately result in failure.

The penetration of the asphaltic cement used in the mixture should be governed by the character of the traffic requirements.

As before stated, the success of all bituminous concrete and bituminous pavements is very largely dependent upon the rolling, and the best results can be obtained only by using a light roller for the initial compression and a heavier roller for the final compression, with an equal amount of transverse and longitudinal rolling.

In the laying of sheet asphalt or bituminous concrete, where brick gutters are used and adjacent to block runners along car tracks, it is good practice to lay the finished surface of the pavement from one-eighth to one-quarter of an inch higher than the brick gutters or runners.

It is difficult in the rolling to secure final compression next to these blocks, and traffic will further compress that portion of the pavement, naturally causing the development of low spots which hold water and result in deterioration.

Special attention should be paid also to the heating of the various aggregates entering into the pavement and also to the combined mix, as many failures are caused by over heating. No over-heated material should be used under any circumstances, as failure is bound to result.

In vitrified block paving avoid the tendency to place too great a depth of sand cushion, as latter-day experience has proved that the sand working up in the joints has been responsible for many failures, and the success of the pavement is dependent largely upon the method of mixing and applying the grout filler. In many cases the grouting, although a simple proposition, has been handled so carelessly that the success of a good pavement has been destroyed.

The practice of placing transverse joints in brick pavements appears to be unnecessary, as the curb joints generally will suffice.

In laying wood block pavements care should be taken to see that the wood blocks are properly protected from the elements when delivered on the job and before laying, as too frequently the material is delivered along the line of work so far ahead of the laying that the blocks dry out, and, after placing, if they become saturated, undue expansion results.

The old road having been resurfaced, its life and success depend upon the maintenance, which in turn depends largely upon attention to details. A patrol maintenance system will do more to preserve roads and pavements and prevent deterioration than any other one thing.

The trouble in the past has been that the average engineer has been interested only in the construction end of the work, while the most important problem confronting the road engineer of to-day is the rehabilitation and proper maintenance of the old resurfaced roads.

Personal Mention

Mr. J. W. Fitzgerald has been appointed Township Engineer of North Monaghan, Ont.

Mr. W. Miller, contractor, of Fort William, has joined the 52nd Overseas Battalion. He is anxious to clear up his affairs quickly, and requests those having accounts with him to arrive at a speedy settlement.

Mr. J. S. MacLachlan, resident engineer at Victoria, B. C., for the Department of Public Works, gave a luncheon address recently before the Victoria Rotary Club. The subject of the address was the Dallas Road breakwater construction.

Mr. W. F. Hume, late manager of the Dominion Architectural Ironworks, Limited, Montreal, has been appointed shop superintendent of the Quebec Engineering Company, Quebec, in connection with a shell contract secured by the latter concern.

Mr. John Pender West, a Winnipeg architect, has enlisted as a private with the 44th Battalion, although recommended for a commission. Mr. West had served two and a half years with the Town Guard of East London, Cape Town, and desired to leave for the front immediately.

Lieut. Hubert Boulnois, R. N., is to be married shortly, according to the London Surveyor. Mr. Boulnois is a son of H. Percy Boulnois, M. Inst. C. E., a number of whose articles on road work have been published in The Contract Record. He is stated to be in command of a submarine "somewhere off the coast of England."

Mr. F. H. Portnall, a well-known architect of Regina, and a partner in the firm of Clemesha & Portnall, has enlisted in the ranks of the 46th Overseas Battalion. It was Mr. Portnall's firm that submitted the successful design in the competition for the new City Hall at Winnipeg, for which they received the first prize of $5,000.

Charles M. Green, a veteran railroad builder and capitalist, died recently at Cobourg at the advanced age of seventy-five years. After serving four years in the Confederate Army, the late Mr. Green constructed a railroad from New Orleans to Alexandra, La., which later was sold to the Texas and Pacific Road, giving that line a Mississippi River terminal.

Mr. George Pilgrim Bowie, architect, 705 Bank of Ottawa Buildings, Hastings Street West, Vancouver, B. C., fell in action in France, on July 7th last. He was thirty-four years of age and was the eldest son of Mr. and Mrs. A. H. Bowie, of Wimbledon, England. He joined the Royal Institute of British Architects as a licentiate in 1911. At the time of his death he was a captain in the Fifth Battalion, First Canadian Contingent.

Mr. J. H. Warder, an old friend of The Contract Record, and Secretary of the Western Society of Engineers, died at his home in Chicago recently. The late Mr. Warder was a graduate of the Polytechnic College of Philadelphia. He had devoted considerable time to bridge inspection, and also had had much to do with planning the power and electric plants of Chicago. At the time of his death he was Assistant Engineer of the Bureau of Sewers of Chicago.

Mr. J. R. Grant, M. Can. Soc. C. E., who was formerly in charge of the bridge and structural steel department of Messrs. Cartwright, Matheson & Company, consulting engineers, Vancouver, is now on active service, having accepted a commission in the Royal Engineers. Mr. Grant's firm has also furnished one Captain, two Lieutenants, and several privates for the Canadian Expeditionary Forces. Mr. A. J. Matheson, M. Can. Soc. C. E., of Cartwright, Matheson & Company, has accepted the position of engineer to the Montreal Water Levels Commission, and is now at Montreal.

Pro Patria

CAPT. G. H. Saltmarsh, of the Metallic Roofing Company of Canada, Limited, Winnipeg, now on active service, was born and educated in England, and entered the British Army at the age of sixteen. Promotion came to him quickly, and he rose from the rank of Private to that of Schoolmaster during a period of service which ended in 1912. Coming to Canada, he was employed by the Metallic Roofing Company until the outbreak of the present war, when he resigned his position and joined the 106th Winnipeg Light Infantry as a Private. He was promoted to Sergeant, and eventually became Colour-Sergeant. In October, 1914, he went to Valcartier training camp with the first contingent. While there he was given his commission, and was appointed Assistant Adjutant of the 106th Light Infantry. With the first contingent he went to Salisbury Plain, but he returned to Canada in December, 1914, to take a position in the third contingent. He qualified at Winnipeg for captain's rank, and was appointed Adjutant of the 45th Battalion at Brandon, which position he occupies at the present time.

Captain Saltmarsh

To mark the completion of the stone work on the new Post Office at Quebec, the contractor, Mr. J. Boivin, entertained his men to a banquet held in one of the spacious apartments on the third storey of the building. Over one hundred workmen were present. The resident architect, Mr. E. M. Talbot, was represented by his associate, Mr. A. Dionne.

Mainly Constructional

East and West—From Coast to Coast

It is stated by Sir William Mackenzie that work is to be commenced shortly on the C. N. R. terminals at Vancouver.

The Elkhorn Lime Company, Limited, Madoc, Ont., has been incorporated with a capital of $250,000. The provincial directors are C. W. Sharp, S. Wellington, W. P. and C. G. Gillespie, and James Skelton—all of Toronto.

Mr. J. F. Wittson, Government Inspector of Roads for Northern Ontario, upon his arrival in Toronto a few days ago stated that the season's road improvement work, involving an expenditure of some $650,000, was almost completed. Mr. Wittson was enthusiastic in his estimate of the possibilities of the clay belt in the north.

It is stated that negotiations for the purchase by the Russian Government from the Canadian Car and Foundry Company of fifty-two million shrapnel and high explosive shells at a cost of fifty-two million dollars have been practically completed. The contract is said to call for the delivery of the ammunition by next April.

The City Architect of Toronto, Mr. W. W. Pearse, reports to the Board of Control that thirty-eight persons are employed in his Department—the same number as a year ago, that two members of his staff are busily engaged on the revision of the building by-law, and that the inspectors have nearly 1,500 jobs on their hands. He also points out that his Department has assumed fire-preventive work in connection with the theatres.

At Hamilton, in the new Public Library, Building, under the auspices of its Hamilton Chapter, the Ontario Association of Architects has been giving an exhibition of various drawings and descriptions of civic improvements which are being carried out in the various towns and cities of the province of Ontario. For some time civic improvement has been a live issue at Hamilton, and it was on this account that the exhibition was arranged.

The citizens of Edmonton will vote on a by-law authorizing the City Council to make a contract with G. W. Farrell and Company, Montreal, for the latter to supply electric power to the city. Farrell & Company propose to develop hydro-electric power on the North Saskatchewan River, sixty miles above Edmonton, at a cost of six million dollars, provided the contract is authorized. The work will be carried out by Sir John Jackson, the British contractor.

A Winnipeg despatch states that Mr. S. Bylander, a prominent English engineer, will be entrusted with the preparation of the plans of the dome for the new Parliament Buildings at Winnipeg. These will be the third plans to be prepared. A Chicago engineer named Shankland was paid $15,000 for drawing one set, but investigation showed that these were made up in the contractors' favor. Mr. Bylander drew the first plans, but they were rejected by Sir Rodmond Roblin.

The new Church of St. Francis d'Assissi on Grace Ctreet, Toronto, is nearing completion. The new edifice will be one of the most beautiful churches in Toronto. The style of architecture is Italian Gothic of the thirteenth century. The auditorium will have a seating capacity of 850. A feature of the building will be a large number of stained-glass windows (estimated cost $6,000) illustrating the mysteries of the Rosary. The building, without furnishings, is being erected at a cost of $112,000. Mr. R. Sheehy, of Peterborough, is the contractor.

A recent issue of the Canada Gazette contains notice of the incorporation of Thomas Kelly & Sons, Limited. The head office of the company is to be at Winnipeg, and the capital stock of the firm is one million dollars. The incorporators are Thomas Kelly, C. B. Kelly, L. C. Kelly, R. L. Worthington, and W. L. Smith. The primary object of their incorporation is "to carry on the business of general contractors for the construction and equipment of all kinds of public and private works and buildings, and of engineers; to construct, execute, and carry out, equip, improve, work, develop, administer, manage or control public works and conveniences of all kinds." It will be remembered for all time that the last important work with which the Kelly firm was identified was the new Manitoba Parliament Building at Winnipeg.

Presentation to George K. Tyler

At Meaford, Ont., at the I. O. F. Hall, recently, the staff of the Seaman Kent Company held a farewell meeting in honor of Mr. George K. Tyler, who for a number of years had filled the position of Superintendent at the company's factory, and who was resigning to take up a more responsible position with Messrs. Knight Brothers Company, Limited, Burks Falls, Ont. The chair was occupied by Mayor Kent, President of the Seaman Kent Company, who in testifying to Mr. Tyler's work was supported during the evening by Mr. Cole, Sales Manager, Mr. J. A. Sinclair, Secretary-Treasurer, and others. During the evening Mr. Tyler was presented with a handsome locket and chain as a token of the regard in which he was held by his associates.

Mr. George K. Tyler.

The Montreal Concrete Works, Limited, 17 Place d'Armes, Montreal, have been awarded the contract for the supply of the reinforced concrete intake pipe for the filtration plant at Cartierville, P. Q., designed by Mr. H. G. Hunter, C. E., of the New York Continental Jewell Filtration Company, under the instructions of Mr. F. C. Laberge, the engineer. The Montreal Concrete Works will also supply the reinforced concrete sewer pipe for the main collecting sewer at Chambly Basin, P. Q., the contractor for which is Mr. S. W. Hamilton, Gosford Street, Montreal. Mr. Francis A. Sylvestre, who was previously connected with the Montreal Concrete Works, has again assumed charge of the sales department.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Chatham, Ont.
The City Council intend to construct about 2,000 feet of 12-inch glazed tile sewer on Richmond Street. Estimated cost, $3,141. Engineer, F. P. Adams.

Cornwall, Ont.
The Town Council intend to construct granolithic sidewalks on Bedford Street and Victoria Avenue. Clerk, J. G. Harkness. Engineer, W. H. Magwood.

Dartmouth, N. S.
Work by day labor is proceeding on the construction of concrete sidewalks estimated to cost $12,000.

Esquimalt, B. C.
The Municipal Council are considering an extension to the sewage system, which will entail about 2½ miles of pipe. Engineer, C. A. Toff, 211 Pemberton Block, Victoria.

Goderich, Ont.
The Town Council contemplate laying a 6-inch watermain on Maitland Street to the plant of the North American Chemical Company. Clerk, L. L. Knox.

Graham Township, Ont.
The Township Engineer, F. N. Rutherford, 24 Queen Street, St. Catharines, is preparing a report on the construction of a road bed between the Industrial Home and Dwyer's Hollow.

Hamilton, Ont.
Work has been started on the laying of a cement pavement on a portion of James Street, estimated to cost $3,000. Engineer, A. F. MacCallum.

London, Ont.
The Chairman of the Board of Control will receive tenders until 10 a.m., October 1st, for (1) 200 square yards of brick pavement on concrete base, and (2) 710 feet of 8-inch sanitary sewer, with connection. Plans, etc., at office of Engineer H. A. Brazier.

Metcalfe Township, Ont.
Tenders on the construction of the Perry and Brown Drains will be received until October 2nd by the Township Clerk, Harry Thompson, R. R. No. 2, Kerwood.

Morris Township, Ont.
The Township Clerk, Alexander MacEwen, Bluevale, Ont., will receive tenders until October 11th for an extension to the Blyth Drain. Tile construction.

Prince Rupert, B. C.
The Town Council are about to construct 980 feet of plank road by day labor. Engineer, William Mason. Estimated cost, $4,500. 9

St. Hyacinthe, Que.
A by-law has been carried providing for the installation of a complete gravity filter system, with a capacity of 4,000,000 gallons per day. Estimated cost, $75,000. City Clerk, A. Messier.

Stratford, Ont.
A sewer will be laid on Avalon Park and Home Street this fall, weather permitting. Engineer, A. B. Manson.

Toronto, Ont.
The Board of Control will receive tenders until October 12th for the construction of West Toronto Sewer System, No. 2 outlet, and for a sewer on St. Clair Avenue. Plans at office of the Works Department.

The City Council have authorized the laying of an asphalt pavement on Yonge Street under the subway. Estimated cost, $9,000.

CONTRACTS AWARDED

Blandford Township, Ont.
The general contract for drain construction has been let by the Township Council to J. W. Clayton, Bright, Ont., and for the supply of tile to B. Blair & Company, Riddell Street, Woodstock.

Hull, Que.
Tht City Council have let contracts for extensions to the watermains to E. R. B. Bisson, Brewery Street, at $35,000, and to Larose & Cameron, Regent St., at $15,000. Pipes will be furnished by the city.

The contract for the construction of a sewer on Laval Street has been let to Bisson & Caron. The clay pipe sewers on Brewery, Farley and Philemon Sts. will be laid by day labor under the supervision of Engineer J. A. Laforest. Estimated cost, $21,200.

Ingersoll, Ont.
The contract for laying a concrete pavement on Ann Street has been let by the Town Council to the Municipal Construction Company, Berlin, at $1.35 per square yard.

Work is progressing on the laying of a concrete pavement and curb for the Town Council. Contractors, Municipal Construction Company, Berlin, Ont. Approximate quantities, 1,800 square yards of pavement, 1,200 lineal feet of curb.

Marquette Station, Man.
A contract for grading has been let by the Municipality of Rosser to A. R. Boivin, 303 Notre Dame Investment Building, Winnipeg. Approximate cost, $5,200. Scrapers will be required.

Ottawa, Ont.
The City Council have let the following contracts:—supply of lock bar pipe, Laurin & Leitch, Park Avenue, Montreal, $194,400; trenching, T. McLaughlin, Somerset Street, $63,514; supply of pumps, Esseih Wyse Company, Zurich, Switzerland, $10,900; motors, Canadian Westinghouse Company, Hamilton, $14,600; special castings, Victoria Foundry Company, Booth Street, $2,455; valves, General Supply Company, Sparks Street, $14,518.

Smithers, B. C.
The Grand Trunk Pacific Railway have let a contract for the installation of a water system to the Prince Ruper Engineering & Equipment Company, Prince Rupert, B. C.

Winnipeg, Man.
The Commissioners of Greater Winnipeg Water District have let a contract for drilling test holes and furnishing cores under the Red River to Henderson & Snyder, 406 Ashdown Block. Contract for recording apparatus not yet awarded.

The Board of Control have let the contract for the supply of water pipes to Canada Iron Corporation, 28 Victoria Square, Montreal.

Railroads, Bridges and Wharves

Drummondville, Que.
Tenders will bt received until 7 p.m., October 1st, by the Town Clerk, W. A. Moison, for the construction of a steel or concrete bridge, with a span of 52 feet. Tenderer to supply plans and specifications.

Toronto Township, Ont.
Tenders will bt received until 1 p.m., October 2nd, by the Township Clerk, C. H. Gill, Dixie, Ont., for the following work at the Barbertown Bridge over the Credit River:—(1) raising the end of the steel bridge, straightening any bent members and lowering bridge on to seats after abutments are completed; (2) building concrete abutment—about 100 cubic yards. Plans, specifications and other information at office of the Engineers, Wheelock & Christie, Orangeville, and of the Clerk.

CONTRACTS AWARDED

Daly, Man.
The contract for the construction of a bridge over the Oak River has been let by the Municipality to Grey & Johnston, Brawardine, Man.

Dover Township, Ont.
The Township Council have let the contract for the construction of three steel and concrete bridges to John Tewkesbury, 224 Lacroix Street, Chatham. Approximate cost, $3,0090. Contractor is in the market for steel to the value of $1,500, three cars of cement and twelve cars of gravel.

Headingly, Man.
The contract for the construction of a bridge over the Assiniboine River has been let to Buchanan & Company, 408 Builders Exchange, Winnipeg. Approximate cost, $3,000.

Public Buildings, Churches and Schools

Calgary, Alta.
R. C. Desrochers, Minister of Public Works, Ottawa, will receive tenders until 4 p.m., October 13th, for the supply and installation of fittings at the Examining Warehouse, Calgary. Plans and specifications with the Architect, Leo

Dowler, Calgary, with L. B. Elliott, District Engineer, Edmonton, and at the Departmtnt.

Granby Bay, B. C.
Tenders on the erection of a school will be received until nooon, October 5th, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of J. H. McMullin, Agent, Prince Rupert, J. Conway, Mine Recorder, Stewart, Miles MacInnes, Secretary to the School Board, Anyox P. O., J. Mahoney, Agent, Vancouver, and at the Department.

Grand Falls, N. B.
Plans are in course of preparation for finishing the interior of the Roman Catholic Church. Architect, R. A. Frechet, 30 Bonnacord Street, Moncton. Work includes plastering on metal lath, and plastic decordation. Estimated cost, $12,000.

Hamilton, Ont.
Tenders for heating, plumbing and electrical work at the Mountain View Hospital are being received by the Architects, Stewart & Witson, Hughson Street S.

Jonquieres, Que.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., October 6th, by the Minister of Public Works, Ottawa. Plans and specifications with T. Gauthiner, Clerk of Works, Jonquieres, A. Dupius, District Engineer, Post Office, Quebec, and at the Department, Ottawa. Specifications only at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Moncton, N. B.
Tenders on the installation of interior fittings at the Post Office will be received until 4 p.m., October 12th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans etc. at office of E. B. Hicks, Public Building, Moncton, D. H. Waterbury, St. John, and at the Department. Specifications only at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Montreal, Que.
Tenders will be called shortly for carpentry work at the premises of the Northern Electric Company at Guy and St. James Streets. Alterations are for the purpose of converting the building into a residential barracks for the troops in training under Colonel E. W. Wilson, Militia Headquarters, 688 St. Catherines Street W.

New Liskeard, Ont.
Work has been started on the construction of the basement of a church for the Roman Catholic Congregation. Seating will be purchased by the Pastor, Rev. J. A. Arsenault, and the Superintendent, Charles A. DeLisle. Approximate cost of work, $5,000.

Toronto, Ont.
The Board of Education will receive tenders until October 1st, for the following work:—temperature regulators, cabinet work, including work benches, tables, cupboards, etc., concrete retaining wall at Roden School, local telephones, electrical work for science rooms at Harbord and Malvern Collegiate Institutes, and the purchase and removal of five old houses on Sydenham Street. Specifications and other information at office of the Superintendent of Buildings, City Hall.

CONTRACTS AWARDED

Barrie, Ont.
In connection with the Library in courst of erection on Collier Street, the contract for heating and plumbing has been awarded to J. J. Neelands.

Bradner, B. C.
The general contract for the erection of an addition to the school has been let to Alund Bros., Matsqui.

Hamilton, Ont.
Work is progressing on the erection of a lodge hall for Thomas Gould, 236 James Street N. The carpentry contract has been let to D. Reilly, 559 Hughson Street N., the contract for steel work to Hamilton Bridge Works Company, Ltd., Bay Street N., and the plastering to Hill Bros., 307 Emerald Street W. Approximate cost, $8,000.

Kamsack, Sask.
Work is progressing on the erection of a brick school for the Trustees of School District No. 1251. General contractors, McKay Construction Company, 50 McCallum Hill Block, Regina. Approximate cost, $15,500. Architects, Storey & Van Egmond, 1013 McCallum Hill Block, Regina.

Lachine, Que.
In connection with the City Hall and Police Station in course of erection on St. Joseph Street, the contract for heating has been let to J. A. Dubois, 444 St. Joseph Street, and for marble work to LePage Marble Works, Ltd., 734 St. Lawrence Boulevard, Montreal.

In connection with the school in course of erection on Fifteenth Avenue for the Roman Catholic School Commissioners, the contract for supply of lumber has been let to L. Villeneuve & Company, Ltd., 2559 St. Lawrence Boulevard, Montreal.

Milton, Ont.
The contract for plastering at the Registry Office now being built has been awarded to the general contractors, P. H. Secord & Son, Ltd., Brantford. Painting and electrical work not yet let.

Notch Hill, B. C.
The general contract for the erection of a school has been let by the Provincial Department of Public Works to E. A. Moore, Notch Hill. Approximate cost, $2,900.

Toronto, Ont.
The following contracts have been let in connection with the Church of the Holy Name, Danforth and Moscow Avenues:—roofing, A. E. Woods, 744 Dovercourt Road; plastering, E. C. Cates, 1 Dingwall Avenue; painting, C. E. Pelletier, 732 Logan Avenue.

Winnipeg, Man.
The School Board have let the contract for the supply of about 800 school desks to T. A. Thornburn & Company, Galt Building.

Business Buildings and Industrial Plants

Aberfoyle, Ont.
James Parker is considering the erection of fireproof farm buildings, estimated to cost $3,000 .

Adelaide Township, Ont.
Russell Parker, Concession 4, Strathroy, is considering the erection of fireproof farm buildings. Estimated cost, $3,500.

Campbellton, N. B.
Plans art in course of preparation for a grist mill to be erected for Robert St. Onge. Approximate cost, $4,500.

Chatham, Ont.
The William Rennie Company, Ltd., 130 Adelaide Street E., Toronto, are building a warehouse and elevator, estimated to cost $20,000. Frame and galvanized iron construction. Superintendent of construction, F. Russell, c/o the Company, Chatham.

Exeter, Ont.
The erection of farm buildings to replace those destroyed by fire is being considered by Joseph Galvin. Fireproof construction.

Howard Township, Ont.
George Lawton, Concession 6, Howard, Ridgetown, Ont., contemplates the erection of farm buildings to cost about $3,000. Fireproof construction.

Kintyre, Ont.
Edwin McMillan, West Lorne P. O., contemplates erectin farm buildings, estimated to cost $3,500. Fireproof construction, concrete and stone foundation.

Malden, Ont.
John Watters, Amhurstburg, Ont., contemplates the erection of fireproof farm buildings to replace those recently destroyed. Approximate cost, $3,000.

Oshawa, Ont.
The ratepayers have passed a by-law guaranteeing 140 acres of land and $60,000 bonds for a steel manufacturing plant to be erected by David Maxwell et al, Traders Bank Building, Toronto. The company will spend $350,000 on the plant before the end of 1916.

St. Andre De Kamouraska, Que.
M. L. F. Germain is considering the erection of a factory for the manufacture of scales, and has been granted an exemption from taxes for five years.

Terrebonne County, Que.
Work will start shortly on the erection of exhibition buildings for the Agrisultural Society of the County of Terrebonne. Secretary, J. Victor Leonard, 159 St. George Street, St. Jerome, Que.

Vancouver, B. C.
Plans for the conversion of the hotel at 1142 Pender Street W. into an apartment house are being considered by J. Elmhirst.

Walkerton, Ont.
Charles Petteplace intends to remodel and equip premises as a store.

CONTRACTS AWARDEL

Chatham, Ont.
Work has been started on the erection of two stores for Fred Bates, William Street. The masonry and plastering contracts have been let to F. Sparks, Sandys Street, the contract for carpentry to James Hendershott, Grand Avenue W. Heating, plumbing and electrical work not yet awarded.

Chippawa, Ont.
Work has been started on the erection of an addition to the factory of Norton Company. Contractors, Brass Bros., Niagara Falls, N. Y. Reinforced concrete construction, concrete founda-

(Continued on page 47)

Tenders and For Sale Department

TOWN OF ST. LAMBERT

Sealed tenders will be received up to 6 p.m., **October 4th, 1915**, for the installation of 42 Lamp Standards complete with about 6,500 feet of Duplex underground cable terminals, etc.

Plans may be seen and specifications and tender form had on application at the office of the Town Engineer.

The Town reserves the right to divide the work into two or more contracts and reject any or all of them.

E. DRINKWATER,
Town Engineer.
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Tenders for Bridge Work

Sealed tenders marked "Tender for Bridge Work," addressed to Chas. H. Gill, Township Clerk, Dixie, Ont., will be received up to one o'clock p.m. on **Saturday, October 2nd, 1915**, for supplying all labor and materials for the following work at the Barbertown Bridge over the Credit River, about one mile from the Village of Streetsville:—

(1) Raising the end of the 94-foot, high-truss, steel bridge, straightening any members which may have become bent, and lowering the same on the bridge seats after the abutment has been completed.

(2) Building a cement concrete abutment (about 100 cubic yards).

Plans and specifications may be seen and all information obtained at the office of the undersigned or at the office of the Township Clerk, Dixie.

The lowest or any tender not necessarily accepted.

WHEELOCK & CHRISTIE,
Civil Engineers,
Orangeville, Ont.
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Department of the Naval Service

Tenders for Miscellaneous Material

Sealed tenders, addressed to the Undersigned, will be received up to noon on **Tuesday, October the 19th**, for the undermentioned items for delivery to H. M. C. Dockyards at Halifax, N. S., and Esquimalt, B. C.

Brass Bars
Brass Sheets
Brass Tubes
Copper Sheet
Copper Tubes
Zinc Plates
Lead, milled or sheet
Antimony
Aluminum
Steel Angles
Steel Boltstaves
Steel Plates
Steel Sheets
Steel for Tools
Iron Firebar
Iron, pig
Iron angles
Iron Boltstaves
Iron Sheets
India Rubber Sheet packing, etc.

Forms of tender and all information may be obtained by application to the Undersigned or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C.

Applicants for forms are requested to state definitely the item or items on which they desire to tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.
Department of the Naval Service,
Ottawa, September 11th, 1915.

Unauthorized publication of this advertisement will not be paid for.—85276. 38-39

TENDER

Tenders will be received by the undersigned up to 8 o'clock p.m. on **Monday, the 4th day of October, 1915**, for the purchase of **$4,661** Town of Weston fifteen annual payment 5½ per cent. local improvement debentures. The lowest or any tender not necessarily accepted.

J. H. TAYLOR,
Clerk.
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Municipal Buildings

TOWN OF ORILLIA

Sealed tenders addressed to the Town Clerk, Orillia, will be received by the undersigned till 12 o'clock noon of **Wednesday, October 7th**, for the following work in connection with the rebuilding of the Municipal Buildings, Orillia.

Plastering Work Painting and Glazing Tile Work Iron Stair and other Miscellaneous Iron Work	Bulk Tenders
Heating Plumbing Electric Wiring	Separate Tenders

A marked cheque equal to five per cent. of the amount of contract must accompany each tender. The lowest or any tender not necessarily accepted. Plans and specifications may be seen at the office of the Town Clerk, Orillia, and of the undersigned.

BURKE, HORWOOD & WHITE,
Architects,
229 Yonge Street, Toronto.
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The Pas, Manitoba

Water and Sewer Extensions

Sealed tenders will be received by the undersigned, Town Clerk of the Town of The Pas, up to 2 p.m., **October 5, 1915**, for the following works:—

Tender A.—Trenching and laying cast iron or steel water mains.

Tender B.—Supply and delivery of cast iron or steel water pipes and specials.

Tender C.—Supply and delivery of fire hydrants and valves.

Tender D.—Supply and delivery of vitrified sewer pipe, trenching and laying of same.

Plans and specifications may be seen at the office of the Engineers, Saskatoon, Sask., the Resident Engineer's office, The Pas, Manitoba, or the Contract Record's office, Toronto and Winnipeg.

The lowest or any tender not necessarily accepted.

H. H. ELLIOTT, M.D., Town Clerk,
The Pas, Man.
MURPHY & UNDERWOOD,
Consulting Engineers,
Saskatoon, Sask.
38-39

(Note that date of receiving tenders has been changed from October 12, as advertised in last week's issue, to October 5.

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents will be received by the undersigned, up to noo of **Monday, October 4th, 1915**, for the construction of concrete sidewalks on the following streets:

St. Mark's Road, Durie Street, and Jillson,

Beresford, Amherst, Lee and Earlscourt Aves. in the Township of York.

Plans and specifications may be seen at th office of the undersigned, 57 Adelaide Street E. Toronto.

The lowest or any tender will not necessaril be accepted.

FRANK BARBER,
Township Engineer
Toronto, Sept. 28, 1915.

Late News Items

Bedford, Que.

The general contract for the erectio of a factory for the Bedford Manufacturing Company has been let to Gra & Dunn, 14 St. John Street, Montrea Approximate cost, $9,000. Saw and lath equipment will be purchased by th Manager, F. D. Welsh.

Halifax, N. S.

Work has been started on the erection of a residence on Oxford Street fo J. H. Rice, 198 Brunswick Street. Th general, masonry, carpentry, roofin plastering and interior fitting contract have been let to the Halifax Buildin Company, 110 Jubilee Road. Approximate cost, $6,000.

Kentville, N. S.

The contract for the erection of a Arena has been let to J. H. Hicks Sons, Bridgetown. Frame construction, paroid roofing. Estimated cos $6,300.

Montreal, Que.

George Samson, 2136 St. Denis Stree has commenced the erection of flats fo E. Vegin, 2632 Drolet Street. Estimate cost, $6,000.

E. Cadieux, 2977a St. Denis Street, ha let the contract for the erection of nin flats to X. Charbonneau, 2977a St. Deni Street. Brick construction, felt an gravel roofing. Approximate cos $9,000.

Orillia, Ont.

Burke, Horwood & White, Architect Ryrie Building, Toronto, will receiv tenders until noon, October 7th, for th erection of a Municipal Building, estimated to cost $30,000.

Toronto, Ont.

Tenders are being received for wirin and plastering in connection with th residence being built on South Drive b H. G. Clarke, 84 Highland Avenue. Architect, James Thomson, 43 Victori Street.

Tenders on plumbing, heating, wiring, plastering and painting at the residences in course of erection on Glendonwynne Avenue are being received b T. M. Arthur, 90 Pine Crescent Roa Approximate cost, $7,000.

Business Buildings and Industrial Plants

(Continued from page 45)

tion and roofing. Approximate cost, $100,000. Equipment will include one electric furnace for manufacturing abrasives.

Crowland Township, Ont.
The contract for the erection of a vinery at Oranova Park has been awarded to William Mitchell, 120 Aqueduct Street, Welland. Brick construction, concrete foundation, Brantford roofing. Approximate cost, $3,000.

Hamilton, Ont.
The masonry contract for the erection of an office building on Main Street E. for the Mercantile Trust Company, Bank of Hamilton Building, has been let to George E. Mills, King Street E.

Lachine, Que.
The contract for scenery and other art work at the theatre being built on Notre Dame Street for LaPlante & Boulanger, 622 St. Joseph Street, has been let to J. Steinsburg, 1183 St. Lawrence Boulevard, Montreal, and the marble work to Lepage Marble Works, Ltd., 734 St. Lawrence Boulevard, Montreal.

Leamington, Ont.
The general contract for the erection of a garage and implement shop for J. W. & N. Coulson has been let to Scratch & Link, Mill Street. Cement construction. Estimated cost, $3,500.

Levis, Que.
The contract for remodelling the factory of M. M. Cote & Jean, 97-99 Commercial Street, has been let to Albert Shaienks, Guenette and Eden Streets. Estimated cost, $4,000.

London, Ont.
The contract for electrical work at the stores being built on Dundas Street for P. B. Fetterly and M. Aylesworth, Huron and Erie Streets, has been let to Benson & Wilcox, Dundas Street, and for painting and glazing to Quick & Son.

Montreal, Que.
A. Mercure, 419 Labrecque Street, has commenced tht erection of a bank and residence on Beaubien Street for the Hochelaga Bank, St. James Street. Estimated cost, $14,000.

The general contract for the erection of a store and flats on Ontario Street for R. Reneault, 3016 St. Lawrence Boulevard, has been let to Louis Penneton, 3016 St. Lawrence Boulevard, and the contract for excavation and masonry to J. O. Chapleau, 2930 St. Dominique St. Approximate cost, $3,500.

In connection with the garage being built on Ottawa Street or the Montreal Light, Heat & Power Company, the heating contract has been let to L. E. Moulton & Company, 142-144 Inspector Street, and the plumbing to Hart & O'Brien, 759 St. Antoine Street. Former report incorrect.

The general contract ofr alterations to a storage building for the Imperial Oil Company, Ltd., 918 St. Patrick Street, has been awarded to James Shearer & Company, 225 St. Patrick Street. Estimated cost, $13,000.

Ottawa, Ont.
In connection with the alternations now being carried out at the premises of R. E. Powell, 290 Elgin Street, the plastering contract has been let to J. Weatherston, the painting to the general contractor, Charles Hopewell, 7 Clemow Avenue, and the electric work to McCallum & Company, 525 Bank Street.

Quebec, Que.
The contract for plumbing and electrical work at the store and residence built on Canardiere Street by J. Carmichael, Notre Dame des Laurentides Street, has been let to J. Lajeunesse, 78 Agnes Street.

The contract for masonry and carpentry in connection with the store and residence being built on Fifth Street, Limoilou, for Victor Giguere, 10 Gosford Street, has been awarded to L. Boivin, 202 Richelieu Street. Other contracts not let.

St. Thomas, Ont.
In connection with the office building in course of erection on Talbot Street for the Huron and Erie Loan Company, 336 Talbot Street, the interior fittings contract has been let to the Office Specialty Company, 97 Wellington Street W., Toronto. Contract for electrical work will be let later.

The Pas, Man.
C. C. Coyle has commenced the erection of a bank and stores for C. H. Anderson. Frame construction, concrete foundation.

Toronto, Ont.
The masonry contract in connection with the work shop to be erected for McGregor & McIntyre, 1139 Shaw St., has been let to Cannon & Son, 75 Brock Avenue, and the carpentry to Brown & Cooper, 297 Carlton Street. Steel construction, concrete floors.

The masonry contract for the erection of an office for the Campbell Mills Company, 12 Monarch Road, has been let to Witchall & Son, 156 St. Helens Avenue, and the carpentry to H. S. Chapple, 239 Evelyn Avenue. Brick construction, felt and gravel roofing. Estimated cost, $4,600.

Walkerville, Ont.
The electrical work at the factory in course of erection for the Dominion Stamping Company will be done by the owners.

Work has been started on the erection of a factory for the Canadian Detroit Lubrication Company, Walkerville. The general, masonry and carpentry contracts have been let to Wells & Gray, Manning House Block, Windsor, the contract for steel sash to A. B. Ormsby Company Ltd., King Street W., Toronto, and for corrugated iron work to Pennington & Brian, 47 Sandwich St. W., Windsor. Approximate cost, $4,000.

Welland, Ont.
The contract for ironwork at the office being built on Cross Street for "The Tribune" has been let to the Standard Steel Construction Company, White Block, and for the remainder of the work to F. C. Diffin. Approximate cost, $8,000.

Windsor, Ont.
The general contract for alterations to a store on Sandwick Street for the Windsor Record Company, has been let to William M. Walker, 41 Jeanette Ave., and the contract for interior fittings to Fox Bros. & Company, Ltd., Sandwich Street W. Estimated cost, $3,000.

P. Harvey, 9 Wyandotte Avenue E., has let the following contracts for the erection of a store and apartments:—general, masonry, carpentry and steelwork, A. Selby, 42 Elliott Street; roofing, heating and plumbing, Pennington & Brian, 47 Sandwich Street W.; plastering, O. O. Lockwood, 153 Goyeau St.; painting, Robert W. Holloway, 125 Glengarry Avenue; electrical work, W. A. Lafave, Bruce Avenue. Approximate cost, $10,500.

Work has been started on alterations to a store building on Sandwick Street for W. C. Kennedy, c/o the Gas Company. The masonry contract has been awarded to George Sewell, 219 Ouellette Avenue, and the carpentry to Urgel Jacques, 160 Dougal Avenue. Approximate cost, $5,000.

The general, masonry, carpentry and electrical contracts for the erection of a garage and factory addition for the Kelsey Wheel Company have been awarded to Wells & Gray, Manning House Block, the contract for steelwork to T. J. Eanson & Company, Pitt Street E., and for roofing and ventilators to Pennington & Brian, 47 Sandwich Street W. Approximate cost, $10,000.

Residences

Exeter, Ont.
William Fletcher, Main Street, is considering the erection of a residence, estimated to cost $3,500.

Ford City, Ont.
Ulysses & Reaume are about to erect two residences by day labor. Brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $7,000.

Glencolin, Ont.
John Gillett, St. Thomas, is building a residence, estimated to cost $3,000. White brick construction, concrete foundation, shingle roofing.

Highgate, Ont.
W. J. Smale is building a residence, estimated to cost $3,000. White brick construction, shingle roofing.

London, Ont.
W. Davidson, 8 Bellevue Avenue, has commenced the erection of two residences on Duchess Avenue, estimated to cost $4,000. White brick veneer construction, concrete foundation.

Maisonneuve, Que.
Sub-tenders for trades required in the erection of flats are being received by O. Gougeon, 560 Pie IX. Street. Mill and encased brick construction, felt and gravel roofing. Estimated cost, $10,000.

Malden, Ont.
The erection of a residence is contemplated by A. M. Atkinson, Amherstburg, Ont. Concrete block construction. Approximate cost, $3,000.

Montreal, Que.
L. Charpentier, 5403 Berrie Street, has commenced the erection of two flats on Ste. Clair Avenue, estimated to cost $4,000.

Ottawa, Ont.
B. A. Grison, 115 Fentiman Avenue, is building a residence on Sunnyside Avenue, estimated to cost $4,500. Stucco and double brick construction, concrete foundation, shingle roofing. Contracts for plastering, painting, heating, plumbing and electrical work will be let later.

The erection of a residence on Sherbrooke Street is being considered by J. W. Foster, 11 Irving Avenue. Double brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,000.

Quebec, Que.

J. Bornais, 76 Third Avenue, is in the market for all materials for painting, plumbing and electrical work in connection with the residence erected on Third Avenue.

In connection with the residence built on St. Valier Street by L. St. Michel, 199 Ste. Therese Street, quotations are being received on materials for roofing, plumbing, heating and electrical work.

Wilfrid Legare, Ste. Foye Road, Quebec, is receiving quotations on all materials necessary for the residence now being erected on Marie de l'Incarnation Street.

G. C. Belanger, Second Street, Limoilou, is building a residence on Third Avenue, estimated to cost $5,000. Frame and brick construction.

C. A. Bouret, 123 Fifth Street, is building a residence on Fifth Street, Limoilou, estimated to cost $4,000. Frame and brick construction, concrete foundation, felt and gravel roofing.

Work has been started by Chrysante Jobin, 168 Latourelle Street, on the erection of a brick and frame residence on Lockwell Street. Estimated cost, $6,000. Concrete foundation, metal and asbestos roofing.

Wilbrod Delisle, 158 Des Stigmates Street, has commenced the erection of a residence estimated to cost $4,000. Frame and brick construction, concrete foundation, felt and gravel roofing.

Work on the erection of a residence on Charlebourg Street has been started by A. Drovin, 39 Sixth Avenue, Limoilou. Frame and brick construction, con0crete foundation, metal and asbestos roofing. Approximate cost, $4,000.

St. Marys, Ont.

Work has been started by John A. McVannel, Wellington Street S., on the erection of a residence. White brick construction, stone and concrete foundation, shingle roofing. Approximate cost, $3,000.

R. J. Hine, James Street N., has commenced the erection of a reisdence, estimated to cost $3,200. White brick construction, concrete and stone foundation, shingle roofing.

Strathroy, Ont.

Plans are being prepared for a residence to be built for J. R. Alexander. White brick construction, concrete foundation, shingle roofing. Estimated cost, $4,200.

Toronto, Oet.

W. G. Speirs, 34 Booo Avenue, is receiving tenders on plumbing, heating, painting, plastering and wiring required at a pair of residences now being built. Reinforced brick construction, shingle roofing. Estimated cost, $4,200.

J. W, Clare, 68 Ascot Avenue, is receiving tenders on hot water heating and plumbing in connection with the residence in course of erection at 1759 Dufferin Street.

Work has been started by W. Whitelaw, 386 Indian Road, on the erection of a residence at 29 Highview Crescent, estimated to cost $4,500. Smaller trades will be sub-let. Brick construction, shingle roofing.

Plans have been prepared for a residence to be erected at 11 Neville Park Boulevard, for H. B. Jackson, 232 Beach Avenue. Brick construction, shingle roofing. Approximate cost, $3,000.

Tenders on the masonry required in the erection of a pair of residences at 12 Kew Beach Avenue will be received until October 3rd by A. Pennock, 90 Waverley Road. Tenders on other trades will also be received—no closing date set. Brick construction, shingle, felt and gravel roofing. Estimated cost, $3,000.

Victoria, B.C.

All work in connection with the rebuilding of the residence and garage of A. J. Woodward, North Quadra St., will be done by day labor.

Windsor, Ont.

Work has been started by L. T. Ward, 243 Dougal Avenue, on the erection of a bungalow, estimated to cost $4,000. Concrete block and frame construction, shingle roofing.

Windsor, Ont.

E. C. Poisson, 18 Gladstone Avenue, is building a double residence on Hall Avenue, estimated to cost $5,500. Brick construction, shingle roofing.

CONTRACTS AWARDED

Dartmouth, N.S.

In connection with the residence being built on Portland Street for W. C. Bishop, the contract for plumbing has been let to J. J. O'Toole, 129 Ochterloney Street, the contract for electrical work to W. Dean, Thistle Street, and the interior fittings to the general contractors, Halifax Building Company, 23 Vernon Street, Halifax.

Thomas Lahey, Water Street, is building a residence for Frederick Coombes, Ochterloney Street. Brick and cement construction. Approximate cost, $10,000.

Galt, Ont.

In connection with the residence being built on Salisbury Avenue for W. Chamberlain, 34 Lansdowne Avenue, the contract for painting has been let to E. Rhodes, Oxford Street, and for heating, plumbing and electrical work to Isaac Bros., 164 Water Street N.

Hamilton, Ont.

Donald C. Wilson, 22 Gibson Avenue, has let the following contracts for the erection of a residence at 20 Fairholt Road:—general, carpentry and roofing, J. P. Thompson, 66 Barnsdale Street; masonry, Shipley & Tomlinson; plastering, F. J. Bellsford, 202 Grosvenor St.; painting, F. Andrews, Kenilworth and King Streets; heating and plumbing, A. Crompton, 469 King William Street; wiring, Gratton Bros., Robinson Street.

The following contracts for the erection of a residence have been let by William Shiswell, Melrose Avenue:—masonry, A. Beddie, 207 Burris Street; carpentry, steelwork and roofing, William Hobbs, 313 Emerald Street W.; painting, G. Foster, Melrose Avenue. Heating, plumbing and electrical work not yet awarded. Approximate cost, $3,500.

Work has been started on the erection of two residences at 73-75 Robert St. for Takefman & Goldblatt, 77 Robert Street. The general, masonry, carpentry and roofing contracts have been let to M. Levy, 213 Park Street N., the painting contract to D. Levy, 213 Park Street N., the contract for heating to the Hamilton Stove & Heater Company, Limited, 50 John Street N., and for plumbing to Clyde Plumbing & Heating Company, 196 York Street. Estimated cost, $5,000.

The following contracts have been let in connection with the residence in course of erection at Dunsmore and Leinster Streets for F. A. Dunlop, 991 Barton Street E.:—masonry and steel, Isbister Bros.; carpentry and roofing, W. Bryant, 18 Clyde Street; painting, W. T. Davis, 153 Rebecca Street. Plastering, heating, plumbing and electrical work not yet let. Approximate cost, $6,000.

The contract for carpentry, steelwork and roofing in connection with the residence being built for William Chiswell, Melrose Avenue, has been let to the general contractor, W. Hobbs, 313 Emerald Street N., the contract for painting to J. Foster, Melrose Avenue, and for heating and plumbing to J. M. Luxon, 607 Barton Street E.

Work has been started on the erection of two residences on Homewood Avenue for Williamson & Torrence, 469 King Street E. The general, masonry, carpentry and roofing contracts have been let to W. Beemer, 26 Smith Avenue, the plastering contract to Hill Bros., 307 Emerald Street N., heating and plumbing to J. Hart, 1 Nightingale St., and electrical work to Pottier & Bizley, 273 King Street E. Approximate cost, $3,600.

The contract for masonry in connection with the residences being built on Stirton Street by Bennett & Thwaites, Barton and Stirton Streets, has been let to R. Jones, 220 Maple Avenue. Brick construction, concrete block foundation, shingle roofing. Estimated cost, $4,800.

London, Ont.

Work has been started on the erection of two residences for J. Glenn, Blackfriars Street. The contract has been let to W. Marsh, 547 William Street. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $4,500.

Maisonneuve, Que.

The general contract for the erection of two residences on Sherbrooke Street for M. & O. Dufresne, Ontario Street, has been let to A. Choquette, 170 Bourbonniere Street. Hollow tile and limestone construction, concrete foundation. Estimated cost, $50,000.

Ottawa, Ont.

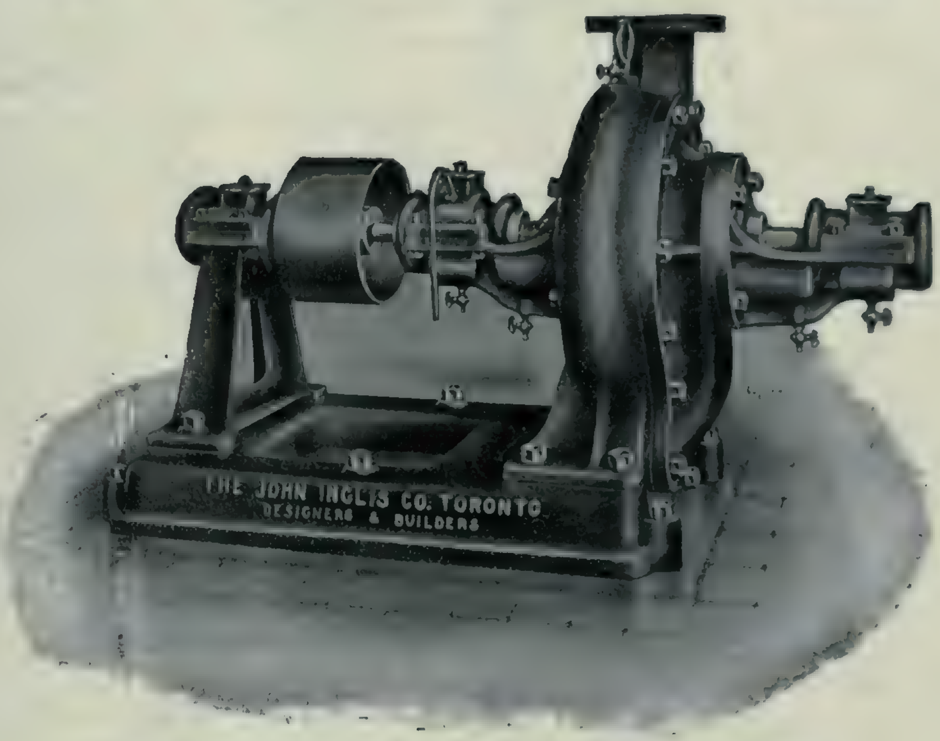
The contract for electrical work at the residence built for T. D. McFarlane, 307 Gilmour Street, has been let to P. Ackroyd, 416 Bank Street.

In connection with the residence built for E. F. Day, 240 First Avenue, the contract for heating and plumbing has been let to W. Walsh, 694 Cooper St., and for electrical work to E. G. Tressider, 58 Fifth Avenue.

The general contract for the erection of a residence for F. C. A. Wingis, 236 Main Street, has been awarded to D. A. Howard, 175 Strathcona Avenue. Brick veneer construction, shingle roofing, stone foundation. Approximate cost, $3,700.

The contract for brick work in connection with the residence in course of erection on Marlboro Street for Barrett

PUMPS



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THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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Bros., 260 Catherine Street, has been let to W. Evans, 319 Bell Street, and the carpentry to E. Wildman, 252 Arlington Street. Other trades not yet awarded.

The general contract for the erection of a residence on Clarence Street for Pierre Delude has been let to A. D. Hudson, Clarkestown, Ottawa. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,400.

Quebec, Que.
In connection with the residence in course of erection on Second Street for N. Ferland Sr., 410 St. Francois Street, the contract for roofing, heating, plumbing and electrical work has been awarded to N. Ferland Jr., 410 St. Francois Street.

Work has been started on the erection of a residence on Scott Street for R. Genest, 40 Cote Ste. Genevieve. The general and carpentry contracts have been let to A. Grenier, 214 Ste. Helene Street. Brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $6,000.

E. Bouchard, 185 Crown Street, is building a residence on Camardiere St. for E. Tremblay, 308 St. Joseph Street. Brick and frame construction. Estimated cost, $5,000. The contract for plumbing and electrical work has been let to L. Lajeunesse, 78 St. Agnes Street.

Work has been commenced on the erection of a residence on Fourth Avenue, Limoilou, for Theodule Bernier, 177 Eighth Street. The general, masonry and carpentry contracts have been let to E. Cloutier, Canardiere Road. Estimated cost, $5,000.

In connection with the residence in course of erection for L. F. Burroughs, 147 Maple Avenue, the masonry contract has been awarded to J. B. Verret & Fils, 184 Third Avenue, Limoilou.

Sarnia, Ont.
The following contracts have been let in connection with the residence being built on Christina Street S. for J. Peterson, 190 Victoria Street N.:—masonry, E. McDonald, 174 Brock Street S.; carpentry and roofing, James Shanks, 272 Wellington Street; heating, plumbing and electrical work, J. Filsinger, 144 Christina Street N. Approximate cost $5,000.

Toronto, Ont.
The contract for excavation in connection with the residence to be erected at 140 Keewatin Avenue by H. C. Long, 901 Traders Bank Building, has been let to Laidlaw Bros., 418 Balliol Street. Other trades not yet awarded. Brick construction. Approximate cost, $3,000.

Windsor, Ont.
The contract for the erection of a residence for J. W. Ward, 243 Dougal Avenue, has been let to Ward Bros., 243 Dougal Avenue. Work to be done by day labor. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,800.

Work has been started by L. D. Galloway, Victoria Road, Walkerville, on the erection of a residence for Mrs. M. Shafer, 70 Crawford Avenue. Brick construction, shingle roofing. Estimated cost, $4,000.

Duncan Clark, Glengarry Avenue, has let the following contracts in connection with the residence in course of erection on Howard Street:—carpentry and roofing, Cecil Creber, 89 Howard Street; plastering, John Reid, Goyeau Street; heating and plumbing, Cecil Jones, 221 Windsor Avenue. Masonry and electrical work to be done by owner.

Power Plants, Electricity and Telephones

Beverley, Sask.
Tenders on the construction of the West Beverley Rural Telephone Company's system will be received until 8 p.m., October 9th, by the Secretary, Geoffrey Mayhew. Plans at office of the Secretary and at the Department of Telephones, Regina.

Blenheim, Ont.
The Town Council are considering the installation of an ornamental lighting system on the main streets. Clerk, G. W. Riseborough.

Goderich, Ont.
The Town Council are considering the installation of electric light and power service at the plant of the North American Chemical Company. Clerk, L. L. Knox.

Liverpool, N.S.
Work is progressing on repairs to the electric light plant for the Town Council. Estimated cost, $10,000.

London, Ont.
The Utilities Commission have ordered General Manager E. V. Buchanan, City Hall, to purchase new transformers for the Hydro Station. Plans will be prepared and tenders called as soon as possible.

Niagara Falls, Ont.
The City Council are considering the recommendation of Electrical Superintendent G. E. Foster that incandescent lamps be substituted for arc lamps on Simcoe Street. Estimated cost, $4,000.

St. Lambert, Que.
The Town Engineer, E. Drinkwater, will receive tenders until 6 p.m., October 4th, for the installation of 42 lamp standards with about 6,500 feet of duplex underground cable, terminals, etc.

CONTRACTS AWARDED

Carleton Place, Ont.
The contract for the construction of the Goodwood Rural Telephone Company's system has been let to Dixon & Gelling, care of F. Taylor, Carleton Place. Equipment purchased.

Dewar Lake, Sask.
The Flaxcombe North Rural Telephone Company have let the contract for the construction of their system to Kindersley Telephone Construction Company, Kindersley, Sask. Contractors will purchase material.

Ottawa, Ont.
The City Council have let a contract to the Canadian Westinghouse Company, Hamilton, for the supply of a switchboard and apparatus at $11,912, and for transformers at $11,253.

Miscellaneous

Cache Bay, Ont.
George Gordon & Company, Limited, are in the market for two double cutting band mills, one horizontal resaw, together with edgers, lath mills, trimmers, etc., for installation at their new mill.

London, Ont.
The Albemarle Zinc Mining Company contemplate the installation of additional crushing, grinding and other machinery at their plant. President, E. S. Woolverton, 214 Dundas Street.

Niagara Falls, Ont.
W. E. McCredie, 66 Barker Street, is in the market for brick, ventilators, metal lath, wood paint, glass, hot air furnace, all kinds of lumber, asphalt roofing, stable fixtures.

Quebec, Que.
Brousseau & Frere, St. Paul St., are receiving quotations on sprinkler systems, vacuum cleaners, hot water boilers, steam boilers, hot air furnaces, skylights, ventilators, plumbing fixtures, electric and steam pumps, metal and gravel roofing, electric light wire.

St. Catharines, Ont.
A by-law has been carried, providing for the granting of a franchise to the Relief Natural Gas Company. Work will start at once on the construction of the company's system, which is estimated to cost $75,000.

Strathroy, Ont.
George Rivers is in the market for one veneer machine, 66-inch knife and other basket machinery.

Tavistock, Ont.
Kalbfleisch & Son are in the market for quarter-cut oak trim, quarter-cut oak veneer doors and cypress sash.

Toronto, Ont.
Edward Ramage, shipbuilder, 265 Wellington Street W., is in the market for one punching machine, capable of punching a 1-inch hole in 1-inch plate, and for rotary bevel shears.

Trenton, Ont.
J. Whiteley, Trenton, Ont., is in the market for brick, cement, hollow tile, metal lath, concrete mixers, store fronts, weather strip, glass—double diamond and plate, hot air furnace, all kinds of lumber, fireproof doors, shutters, skylights, ventilators, wood paint, all kinds of roofing, stacks, woodworking machinery.

Windsor, Ont.
The City Council have decided to purchase one auto tractor for the aerial truck and one service auto truck. Total cost not to exceed $11,000. Clerk, S. Lusted.

CONTRACTS AWARDED

Quebec, Que.
The Tercentenary Commission have let the contract for the erection of a fountain and monument on the Ronde de Chaine to G. Vennat & Company, 16 Notre Dame Street W., Montreal. Work includes a pedestal of Stanstead granite, 36 feet high, a statue of "Faith" and four large bas-reliefs. Approximate cost, $12,000.

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Passing Verdicts on the Insurance of Office Tenure

If the letters published in this issue dealing with the suggestions advanced by Mr. J. W. B. Blackman, City Engineer of New Westminster, in our issue of September 15 may be taken as representing even a fair percentage of the opinion of the municipal engineering profession in Canada, little hope can be entertained of making a success of the scheme at this stage of our history. While the letters received are few in number, it is significant that they emanate from men occupying high positions in the profession. The City Engineers of Montreal, Vancouver and Victoria are united in the opinion that an insurance of office tenure is not feasible.

The feasibility or non-feasibility of a scheme must remain an open question until it has been either put to a practical test or shown to be of inherent weakness in the fundamental of dollars and cents. In regard to its practical application, Mr. Fellowes expresses doubt as to whether any insurance company would undertake the business for the profession on a satisfactory basis. This objection is met—in a measure, at any rate—by the fact that a firm known as the Official Security Company, Limited, of London, England, are disposed to lend their assistance in the formation of a Canadian organization—with a view, of course, to handling the business that would ensue. The specimen policy (reproduced in this issue) forwarded by this firm to the originator of the scheme is interesting in the comprehensive manner in which it provides for the hundred and one real and imaginary difficulties which may be conjured up.

Mr. Paul Mercier, Deputy Chief at Montreal, asks whether such an organization would not be derogatory to the profession. We think not. Protective measures or the absence of such are a matter of strength and weakness only. On the face of it it is more derogatory to a profession to be so lacking in organization and influence that its members are capsized by every squall, than it is to be protected by a well-organized body constituted in such a way as to be able to call upon the whole profession to withstand an onslaught upon one of its members. Nothing could be more derogatory to municipal engineers, or more hurtful to their pride, than the disgraceful scenes which have been enacted in some of the municipal chambers during recent years. It has not been an uncommon thing to find personal violence offered the engineer. Vilification and libel have been rife. The manner in which the names of even past presidents of the Canadian Society have been dragged through the mud by way of inspired articles in the press is beyond the pale of decent resentment. No; the enlightened administrators of the affairs of the average town and city are not to be handled with white kid gloves.

City Engineer Rust, one of the best known men in the profession (and by the same token one of the most experienced), tells us that this insecurity of tenure will continue until the public is educated to a higher appreciation of the services of the engineer. Doubtless it will; but until some measures are taken with a view to raising the status of engineers, and strengthening their position among the professions, how will this ever be brought about? Time goes on, and the interests of Canadian municipal engineers have no more protection than they had a quarter of a century ago.

The proper course would be to have the suggestion thoroughly sifted at the next annual meeting of the

Canadian Society of Civil Engineers. This is the view entertained by Mr. Archibald, the City Engineer of Saskatoon. Much valuable time has been spent by the Society in the discussion of matters of far less vital moment.

Mr. Blackman's scheme may be practicable or impracticable—one cannot but admit that there are grave difficulties in the way of its financing and administration—but there is a measure of enterprise and originality in the suggestion that will appeal to those younger and more ardent members of the profession who believe that the strenuous life of the twentieth century calls for "something different."

In this last sentiment we are at a little variance with Mr. Owen McKay. We have known men of the aggressive type that he has in mind, but in the strenuous competition of later days we have found the average young engineer quite content with something comparatively permanent if the post is a half-decent one.

Customs Duty on Plans

A Winnipeg correspondent of The Contract Record recently wrote to the Collector of Customs in Regina regarding the entry of plans for the erection of the Robert Simpson Company's building there. The reader will no doubt be able to guess the tenor of the reply:—

> In answer to yours of the 18th inst., I beg to say that the Robert Simpson Company have fully satisfied the requirements of the Customs as to entry for plans.

Not finding this information sufficiently illuminating or satisfactory, our correspondent then wrote to the Collector and asked for the date upon which the entry was made, in reply to which he was told:—

> I beg to acknowledge the receipt of your letter of the 23rd inst. I am sorry to state that I am unable to give you further information.

We are informed that Customs officials are not allowed to give out dates, and that the only way in which this information can be secured is through Ottawa, or from the local representative in the House. The Dominion representative for Regina is W. M. Martin, barrister, of Regina.

There appear to be certain branches of the Civil Service whose particular characteristic is that their utility leaves off just where it is needed.

The Licensing of Engineers

IN the discussion of this subject which has ensued upon the publication of Prof. Young's letter in The Contract Record of September 12, a number of interesting letters have been forthcoming. Special attention is directed to the communication by Mr. C. E. W. Dodwell, of Halifax. The writer of this letter has had a long and useful association with the Canadian Society of Civil Engineers, and he knows whereof he speaks. His views may be diametrically opposed to many of his fellow practitioners', but they are all the more interesting on that account, perhaps.

Mr. Dodwell's letter is evidence that there is still a faction of the profession in Canada which is sufficiently old-fashioned to believe that temporary sacrifices made with a view to improving the future status of the engineer are worth while.

For ourselves we are by no means committed to engineering registration, but we must confess to an appreciation of the sound common sense behind Mr. Dodwell's observations.

To Build or not to Build

The Viewpoint of the British "Brickbuilder"

THE question as to whether or not building operations should proceed is engaging the attention of interested parties at the present moment. In the early days of the war, when with our British self-complacency we imagined that six months, at the most, would see the end of hostilities, there was a pretty generally expressed desire that business should proceed as usual. When, however, every available man with a spark of patriotism in his nature was being polled for his country's service, and the cry was for still more and more men, the Government put pressure upon local authorities, urging them to release labour and to save capital outlay. This necessarily threw out of employment men above the fighting age, but at the same time it meant a large accession of men to the colours. Some of the unemployed found work in other directions, and in the meantime the younger generation of architects joined the forces, and the older men at home found a rapidly dwindling list of clients. Under the circumstances, it is doubtful, the spirit being willing, if any but the most generously disposed could have indulged in the luxury of building. Labour is more easily dispersed than acquired, and the increased cost of material, together with the difficulty of obtaining regular supplies, had brought building almost to a standstill. No one begrudged the Government any available man, but there were still left a vast number of military ineligibles, who were engaged in the decoration and refurbishing of houses. Many owners of property, in order to keep going this department of the building trade, went out of their way to find it work, and their action has proved of great service, especially to the small builder and decorator in our country towns and villages. Yet it would appear that even he, with his depleted hands, is in danger of losing such little business as will "keep him going." The Parliamentary War Savings Committee, with a burning desire to inculcate thrifty habits on the people, but with little or no knowledge of special circumstances, and presumably nothing of special trades, advises that "no one should build a house for himself at this time," and that "decorations and enlargements should be cut down as much as possible."

Had this committee sought the assistance of anyone connected with the building industries, it would have known that advice as to non-building was superfluous, and it would, further, have ascertained that the very best suggestion it could put forward would be that householders should embrace this opportunity of providing labour for the jobbing builder and his impoverished staff. We are glad to note that a firm remonstrance on the subject has been put forward by Mr. Ernest Newton, the distinguished President of the R.I.B.A. He says:—

"At the first glance this advice will seem admirable, especially to those in no way connected with building work; but I venture to think that, if carried too far, it may have disastrous and perhaps unforeseen effects. Economy is impressed on all classes of the community in order that they may by their savings help to pay for the war. A strong point in our financial position is that even during war time our industries are kept going so far as possible, and thus everyone is able, more or less, to pay his way.

"To stop all but absolutely necessary building would, no doubt, keep money in the pockets of those able perhaps to afford a modest and prudent expenditure in house building, decorating, and furnishing, but it would entirely deprive of all means of livelihood a very large number of people beyond military age and with no aptitude for munition making or other definite war work, even if it could be found for them. These men must inevitably become a burden on the community, and, consequently, what is saved in one direction is lost in another. Almost everyone connected, directly or indirectly, with building work already finds his income greatly reduced, indeed in some cases the vanishing-point is almost in sight, and if work of this nature ceases entirely complete ruin is inevitable. It may be that this suggested further restriction of expenditure is absolutely necessary, and, if so, there is no doubt that the position will be faced with fortitude and resignation. All I ask is that before the suggestion, which will really have the force of a command, is made officially we may have an assurance that the committee have had the benefit of the experience of those conversant with the matter in all its complicated ramifications, and that the whole matter has been most carefully considered."

The Royal Institute of British Architects has already offered to give every possible assistance to the Government in dealing with matters that come within its knowledge, and it is unfortunate that its overtures are ignored.

A Yorkshire builder puts the case even more emphatically in asking:—"Why should the builders be made a national scapegoat? No one can speak on building values with greater authority than I can, and I have no hesitation in saying that the very opposite is the best advice, and that very few citizens will live long enough to know building prices generally lower than they are now. True economy is certainly to build at such a time. Whenever France and Belgium require rebuilding, they will require precisely the same materials as we require to build to-day; and with such a demand prices will necessarily rise. In Yorkshire we have been taught for a generation before the hysterical shrieks of the present ephemeral economists not only to economise and save our money, but to invest it in the house we live in. The consequence is that more people in Leeds and Bradford own their own houses—the fact makes them better citizens—than in any other cities of the size in the Empire."

Of one thing we may be certain: when the war has ended, the price of building material will be for a time almost prohibitive, and the difficulty under happier conditions will still obtain for a time—that of acquiring the necessary material and men.

Good Prospect for Immigration.—U. S. Looking to Canada

THE return of Canada to a state of normal business activity, independent of war orders, will obviously depend very largely upon the extent to which immigration can be restored to its ante-bellum figures, says a writer in The Financial Times. Canada has for some years past been adding to her population at the rate of 300,000 persons per annum, and of late years has brought her industries about to the point where they can cope with the demands arising from such a movement. That immigration has now been entirely cut off, while we have lost through the movement to Europe of our own troops the British and Continental reservists, and a good number of families pertaining to the latter, fully a hundred thousand of our residents during the year of war. It will be a considerable time, no doubt, before we can look for the restoration of the stream of migrants from Europe, in view of the terrible reduction of population now going on there and the fact that military activity will be succeeded there by a considerable measure of industrial activity when the war is over. The question of prime interest in Canada, therefore, is the question: how much immigration may we expect from the agricultural sections of the United States?

Now agricultural immigration from the United States to Canada is a more or less recent economic factor in the progress of this Dominion, and it is generally recognized as due to one predominant cause, namely the immense rise in the price of farm lands in the wheat-raising States. And it is very encouraging to find that this condition, so beneficial to Canada, is being reproduced in the United States this year upon a scale perhaps unprecedented in history. The gigantic crops of the year 1915, and the high prices prevailing as a result of the war, are leading to a demand for farm lands in the best agricultural areas which, according to a trustworthy observer, is sending up the price of these lands five, ten and even twenty dollars an acre at a single bound.

The treasurer of the Minnesota Loan & Trust Company, following a trip through the harvest fields, has stated that higher prices are prevailing in farm lands in Minnesota, North Dakota, South Dakota, Northern Wisconsin, Northern Iowa and parts of Montana—the very territory which has so largely contributed to the immigration of moneyed farmers into Canada in recent years,—and that there is an increasing supply of money available for mortgage loans on such property, which is a very important factor in establishing prices. This upward tendency he considers to be thoroughly justified by the value of the crop product.

Such a movement of prices will inevitably throw into high relief the comparatively moderate price of good farm lands in the Canadian West, and prove a potent influence in inducing the younger and less wealthy farmer of Dakota and Minnesota to remove across the border. And be it remembered that this is the one and only species of immigration that Canada must of necessity maintain if she is to continue to go ahead. We can do without the artizans and town-dwellers generally, and particularly without the railway navvies, for whose services we shall have but a limited need upon the conclusion of our new transcontinentals. But we cannot do without a constant increase in the producers of our exportable wealth—

our wheat, our livestock, our coarser grains and our dairy products. We must do everything in our power to make agricultural life in the West as attractive as possible to these potential future citizens who are being crowded out of the wealthy American States; and we must do all we can to provide for them the same accommodation in the way of mortgage loans—proportioned to lower capitalization of their farm lands here—as they receive in the States from which they come.

The Engineer a Practical Idealist

Extracts from the Presidential Address of Charles D. Marx, delivered at the Forty-Seventh Annual Convention of the American Society of Civil Engineers in San Francisco on Sept. 16.

LET us turn in detail to various branches of our profession, and see if the practice of them is likely to be destructive of idealism. The Mosaic code of laws shows that the health of the Jewish population was a matter of such supreme interest that special legislation on that subject seemed warranted. The Greeks, and particularly the Romans, recognized fully the moral value of personal cleanliness, but it has been left to our country to show clearly and on the basis of scientific study the interdependence between sanitation and disease, sewerage and crime. Munsterberg has said, "Hygiene can prevent more crime than any law." Speaking before the Massachusetts Conference of Health Officials, Dr. Charles W. Eliot, president emeritus of Harvard, addressed them, in part, as follows: "The progress of knowledge of preventive medicine made during the past fifty years, and in applications of that knowledge in social practice, has been the most cheerful phenomenon in the recent history of civilization. The new applications of physical forces—heat, light and electricity, which mankind has learned to use in its conflict with nature—have proved to be highly beneficient in the field of preventive medicine. Civilized communities have been enabled to make their water supplies, food supplies and drainage systems safe, and to contend with unexampled success against formidable pestilences, the common communicable diseases, and the bodily ills which attend urban life and the factory system."

Sanitary Engineering Achievement

In this work of preventive medicine the sanitary engineer has borne his full share. As we read these inspiring words of Dr. Eliot our thoughts turn at once to that monumental work in sanitation carried out on the Panama Canal under the direction of General Gorgas, and with the hearty co-operation of the engineering staff. Under disheartening difficulties, and with sacrifice of personal comfort, yes, at the risk of their lives, the men labored who made the Isthmus a place fit for the white man to live, and thereby made the construction of the canal, which means so much to mankind, possible. Honor, deserved honor, has come to him who directed this splendid piece of sanitary engineering, but I desire to put on record here the appreciation of this society for the men who stood by. Is it reasonable to suppose that the engineers who did this work, who made these sacrifices, were not the highest type of men—practical idealists?

We are called iconoclast engineers, utilitarians, non-respecters of tradition, antiquity and picturesqueness. Iconoclasts? Yes; reformers usually are. Utilitarians? That, too, is an accusation that we cannot deny, but is an act less noble for being useful? Non-respecters of tradition and antiquity? Again we plead guilty, if tradition stands for error, and antiquity for decay. Destroyers of the picturesque? A general denial cannot be entered against this charge either, and in some cases, I am free to confess, too little justification can be shown for the disregard of the picturesque. This is a point I shall touch upon more fully later, but with special application to the cases cited above and similar ones, what is picturesqueness but the diseased condition of structures and their surroundings? What is this vaunted love of the picturesque, in many cases, but a selfish and thoughtless appreciation of surface appearances? Selfish and thoughtless, I say, because the few are willing to sacrifice the health and happiness of a whole community, perhaps, in order that they may feast their eyes on narnow winding streets, on quaint gables, far-reaching eaves, small, curiously leaded panes of glass. They are taken in by the surface appearance of things. But little heed give they to the squalor and dirt, the misery and sickness existing in these picturesque quarters. Who, then, is the idealist—the man probing into the sore which has so little surface indication, finding its deep-rooted seat, and skilfully using the knife, or the man who, misled by these same facts, applies a surface dressing and allows the sore to eat into the body? To the thinking man the answer is simple. Perhaps you will grant now that at least one branch of engineering, sanitary engineering, and idealism are not only not incompatible, but that they are almost inseparable. And what I have shown somewhat fully for this branch of the profession can be shown as well for the many other branches.

Irrigation Opens New Territory

Take irrigation engineering, for instance, the possibilities of which are only beginning to be realized in this country. Is it likely that the men carrying out these works see in them but the piling of one stone upon another, the digging of so many feet of pipe? These black cast or wrought iron cylinders stand for more than this to the true engineer. He realizes that with every water or drain pipe well laid he is bringing prosperity and happiness, health and vigor, where before existed poverty and misery, sickness and langour. Perhaps the most wonderful instance on record in modern times of the far-reaching effects of irrigation engineering is found in Egypt. In an article on the regeneration of Egypt by the former librarian at Stanford, Mr. Woodruff (now professor of law at Cornell), he unhesitatingly and justly, I think, attributes a large share of the credit for this "new birth" to the work of the English engineers. Mr. Woodruff says, "The history of the English in the administration of Egypt for the past nine years is the record of the return to health, strength and prosperity of a country that has been bled and starved almost beyond resuscitation. And yet there has been little romance in this restoration. It is chiefly a story of common sense, honesty and straightforward hard work."

But we need not turn to foreign countries to find work of the irrigation engineer worthy of commendation. Our own Reclamation Service has made a record of which we may well feel proud. Here, too, the men, with loyalty and steadfastness, have given a service the value of which is not yet fully recognized. They are the men of whom Chief Engineer Davis said: "Their chief tie to the service is not the matter of salary, but interest in their work and loyalty to it and the belief that they are appreciated." Again I ask, is such work destructive of idealism? are such men lacking in ideals?

Railroads Unite Mankind

In railroad engineering, think you that the men who through virgin forests and sandy deserts, through miasmatic swamps and rocky canyon, across rivers and over mountains, carried the steel bands that now tie mankind so closely together—think you that these men were engaged in an occupation likely to kill their ideals? When the final balance is struck, I warrant that the debit will not be on the side of this grand army of peace of the present, as compared with the armies of war of the past and present, for deeds of ideal heroism, self-sacrifice and devotion to duty. It seems like carrying coals to Newcastle to speak in an audience like this of what the railroads have done for all countries—for our own country especially, and more particularly for the Pacific slope. It was not so long ago when I read of the beginning of construction of the Trans-Siberian Railway which now unites the Atlantic and the Pacific on the other continent. The Cape to Cairo Railway, too, has passed through the stages of its preliminary surveys and partial construction. What centuries of fighting could not accomplish these two roads will in time accomplish. The light of civilization will be spread on the Dark Continent, and its strong rays will burst the fetters and open the prison doors of suffering men and women in Russia. Who then is destructive of idealism—the man whose works are a means, if but a humble one, of bringing his fellow beings into a direct contact with the wonders of creation, or he who, enveloped in the mantle of exclusiveness, bemoans this defiling contact?

Romance of Bridge Building

What bridge engineer has not been touched by the romance of his profession? What engineer has not been thrilled by Kipling's story of the "Bridge Builders," where that master hand has voiced in prose which is almost poetry the thoughts that came to the engineer as he viewed his work? "It was a long, long reverie, and it covered storm, sudden freshets, death in every manner and shape, violent and awful rage against red tape half frenzying a mind that knows it should be busy on other things; drought, sanitation, finance; birth, wedding, burial, and riot in the village of twenty warring castes; argument, expostulation, persuasion, and the blank despair that a man goes to bed upon, thankful that his rifle is all in pieces in the gun case. Behind everything rose the black frame of the Kashi bridge—plate by plate, girder by girder, span by span—and each piece of it recalled Hitchcock, the all-round man, who had stood by his chief without failing him from the very first to this last."

If I desire to show that in still another branch of engineering—the one of river and harbor improvement—there is nothing destructive of idealism, I need not go far for an illustrious example. What James B. Eads has done for the people living in the Mississippi Valley in opening up the mouth of the Father of Waters stamps him as one of the benefactors of mankind. For years he labored and fought; removed mountains of obstacles, overcame prejudice, malice and ignorance. Mr. Corthell, the staunch friend and principal assistant of Captain Eads on this momentous work, quotes him as saying, "I therefore undertake the work with a faith based upon the ever-constant ordinances of God Himself; and so certainly as He will spare my life and faculties for two years more, I will give to the Mississippi, through His Grace and by the application of His laws, a deep, open, safe, and permanent outlet to the seas."

Art and the Engineer

I think enough has been brought before you now to show clearly that engineering is not destructive of idealism. That much refuted, there still remains the charge that engineering is destructive of, or at least in part responsible for, the decay of art. I propose to show that this statement also is false. Artist and romanticist appear as accusers. Again they point backward and say: "See what the past has created; what have we that can be placed by its side?" Their eyes are blinded to the changed condition of things. They lack the sympathetic understanding of the complex problems of the life of to-day, and the materialized solution of these problems does not appeal to their idea of the beautiful. For the intelligent enjoyment and, more particularly, for the criticism of any creation, there is needed at least a fair knowledge of the underlying principles of construction, be that work a symphony, a poem or a bridge. It is true that a symphony or poem appeals much more readily to a large audience than does a bridge or a complicated piece of machinery; yet both the latter may be as much works of art as the former, a higher degree of development of the intellect being needed, however, to see and feel their beauty. Every engineering structure is the materialized idea of its function. The ideas underlying engineering works are often ideal ones, and the works themselves therefore can be idealized. When this is done the engineering structure becomes a work of art.

In all ages that which most truthfully and characteristically embodied in itself the representation of the life and the ideas of those times was deemed a work of art. He is the artist who expresses most faithfully what we think and feel. If such representation has not been had in our century, it is not for lack of new ideas and materials furnished by science pure and applied, but for the lack of adequate assimilating power on the part of the would-be apostles of the beautiful.

The Artistic in the Structures of the Panama Canal

It is encouraging to note that our own government in connection with the structures of the Panama Canal sent the sculptor, Daniel C. French, and the landscape architect, Frederick Law Olmsted, to report on the artistic character of the Isthmian structures and to make suggestions for such improvements as to them seemed desirable.

"The canal itself and all the structures connected with it impress one with a sense of their having been built with a view strictly to their utility. There is an entire absence of ornament and no evidence that the aesthetic has been considered except in a few cases as a secondary consideration. Because of this very fact there is little to find fault with from the artist's point of view. The canal, like the pyramids or some imposing object in natural scenery, is impressive from its scale and simplicity and directness. One feels that anything done merely for the purpose of beautifying it would not only fail to accomplish the purpose, but would be an impertinence." Thus spoke the true artists.

Is it Profitable to Beautify Engineering Works?

Is it profitable to beautify engineering structures? Here we stand before a momentous question. If the answer be given by the engineer, or by one who holds that the status of a people is determined not merely by the accumulated wealth of the nation, the quantity of goods produced, and of articles manufactured, then it will be in the positive, ten times over. But if the man of low ideals and mercenary motives gives answer, it is likely to be an emphatic "No." This answer has been given too often in our own country, and the blame for the deep scars in the face of nature, the ugly dams and rugged cuts, must not be laid on the shoulders of the engineer. Where broad-minded liberality and far-seeing policy govern the construction of engineering works, as is the case in countries older than our own, these works stand as worthy art products of the spirit of the times symbolical of the best and highest in the life of to-day.

Science and its applied form, engineering, therefore, have not been destructive of idealism, for in the words of another: "When the period of history we now call modern will be rounded to completeness, all the highest and most sacred human ideals will not be lost or dimmed, but will become nearer and more real," and science has not been destructive of art or beauty. As Emerson says, "Beauty will not come at the call of a legislature, nor will it repeat in England or America its history in Greece. It will come, as always, unannounced, and spring up between the feet of earnest men. It is in vain that we look for genius to reiterate its marvels in the old arts; it is its instinct to find beauty and holiness in new and necessary facts, in the field and roadside, in the shop and mill. Proceeding from a religious heart, it will raise to a divine use the railroad, the insurance office, the joint-stock company, our law, our primary assemblies, our commerce, the galvanic battery, the electric jar, the prism, and the chemist's retort, in which we seek now only an economic use. Is not the selfish and even cruel aspect which belongs to our great mechanical works—to mills, or railways, and machinery—the effect of the mercenary impulse which these works obey? When its errands are noble and adequate, a steamboat bridging the Atlantic between Old and New England and arriving at its ports with the punctuality of a planet, is a step of man into harmony with nature. The boat at St. Petersburg, which plies along the Lena by magnetism, needs little to make it sublime. When science is learned in love, and its powers are wielded by love, they will appear the supplements and continuations of the material creation."

TWO drill boats used in submarine excavation for the ocean terminals at Halifax, N. S., drill their holes through 6-in. casing pipes, which are pulled by clamping them to the boat and raising the scow on its spuds. The charges of dynamite are made up in cartridges and lowered to the bottom of the holes with the wires attached to small floats, which support them at the top of the water while the casings are being withdrawn. When these casings are clamped to the scow at the level of the deck, the spuds are shoved down, raising the boat and the casings with it until the latter are free and can be withdrawn. The boat is then removed some distance, the lead wires carried on the floats are connected up, and the blast is fired with a battery. Dynamite is carried on a special scow, which is shown in front of one of the drill boats in the accompanying photograph. This drill boat carries a battery of seven drills, while the other is equipped with a battery of ten. The work on the Halifax ocean terminals is being carried on by Messrs. Foley Brothers, Welch, Stewart & Farquier, with Mr. L. G. Fuller as General Superintendent.

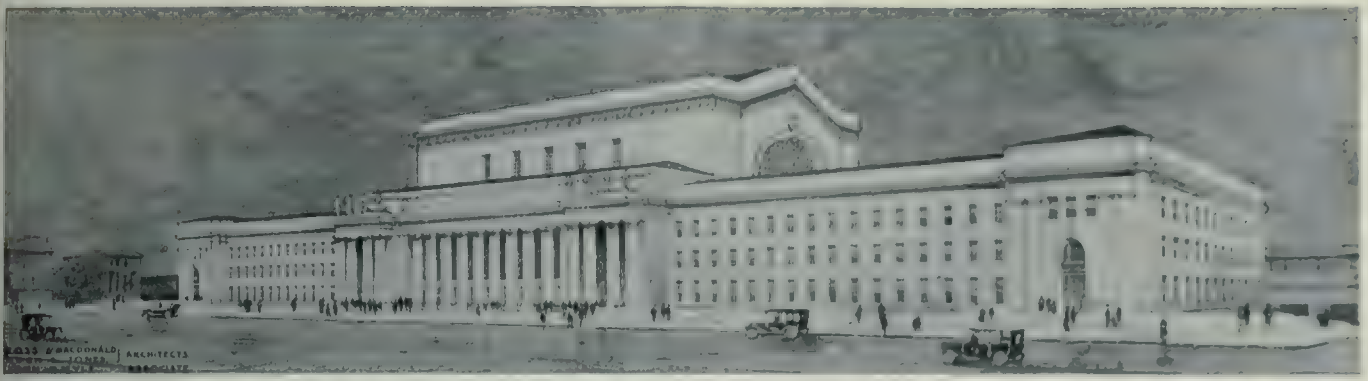
Canada's Railway Mileage

CANADA'S operating railway mileage totaled 30,795 on June 30, 1914, according to the annual report, recently issued, of the Dominion comptroller of railway statistics. This represents an increase of 1,492 miles during the fiscal year 1914. The greatest yearly gain from 1908 to 1914, inclusive, was in 1913, when 2,575 miles were added, but in none of the other years was the 1914 increase equalled. The province showing the greatest gain was Saskatchewan, which added 438 miles and is now second, with 5,089 miles. Ontario has 9,255 miles. Saskatchewan passed Manitoba in 1912 and both passed Quebec in 1913.

The foregoing figures cover only the lines under operation. In addition 11,472 miles were surveyed in the whole Dominion in 1914, 5,521 were under contract and 3,417 were completed but not in operation. The bulk of this mileage was in the western provinces. Alberta had 805 miles under contract and 1,189 completed but not in operation, while the corresponding figures for British Columbia were 1,235 and 698; for Saskatchewan, 340 and 555 and for Manitoba, 108 and 134. Ontario rivalled any single western province, with 1,841 miles under contract and 836 completed but not in operation.

Notable Building Feat

TWO thousand tons of brick, steel, and wood underpinned without accident, damage, or settling more than 1/16 in. is the feat accomplished recently in shoring the front end of the Adams Express Company Building, Chicago. This work was done in connection with the enlarging of the basement and bank floors of the building. About 2,500 24-in. jacks, capable of lifting five tons each, were cut out and replaced by 20-in. needle-beams. A side of a pier was cut out at a time and small pump-locks and screws placed until the entire pier rested directly on the jacks and drums. Then the jacks were removed one row at a time and the needle-beams inserted. In order to take the load off the piers the contractor shored under the ends of the beams with five rows of drums and screws. The piers were then removed and the structural steel set in place. Level readings were taken on the piers three times a day to keep track of any tendency to settlement. In order to maintain the building at the original level, men were kept constantly turning the screws. The blocking settled 8 in. but the piers have never been below their original level.



Work Started on Toronto's New Union Station

OPERATIONS commenced last week upon the erection of Toronto's proposed three-million-dollar Union Station. The contractors, the Peter Lyall & Sons Construction Company, Limited, have a large force of men on the job, and it is stated that the work will proceed during the winter months and he pushed aggressively to completion.

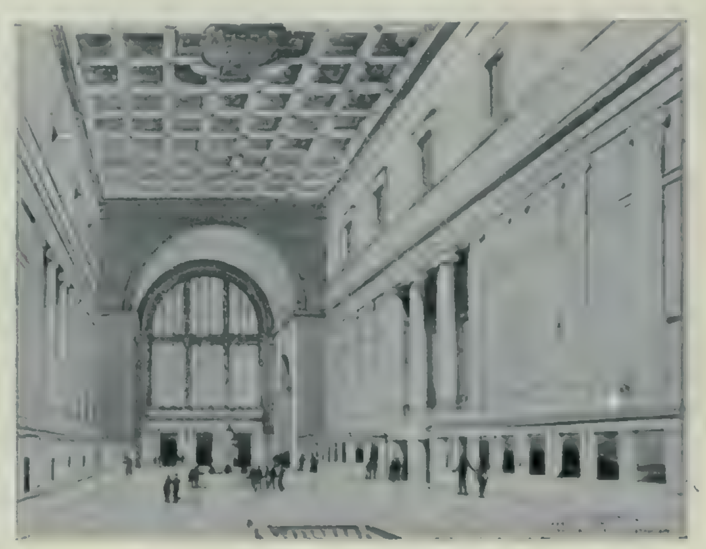
The agreement for the new building was entered into by the G. T. R. and C. P. R. some two and a half years ago. Toronto Terminals, Limited, which was organized by the railways, appointed at its consulting engineers Mr. H. R. Safford, Chief Engineer of the Grand Trunk, and Mr. J. M. R. Fairbairn, Assistant Chief Engineer of the Canadian Pacific, with Mr. J. R. W. Ambrose, Engineer of Grade Separation, as Chief Engineer of the Terminal. Messrs. Ross & Macdonald and Hugh G. Jones received the appointment as architects, and subsequently they appointed as their local associate Mr. John M. Lyle, of Toronto.

The building, which will be of stone construction, is being erected on the south side of Front Street on a site extending from Bay Street to York street. The interior has been designed in an adaptation of Roman classic architecture. The idea has been to secure a beautiful and dignified effect by the use of plain and simple wall surfaces, and the sparing use of ornament, which becomes dingy and dirty in a few years on a building of this character.

In its new Union Station the city of Toronto will have a railway terminal second to none on the continent. In the design every comfort and convenience have been provided for the travelling public. On entering the station passengers will enter a large ticket lobby approximately 250 feet by 90 feet long. All the general business facilities of the station are contained within this lobby. In the centre of the room is the Information Bureau. On one side are the ticket offices, to the number of twenty. At one end of the ticket lobby is the restaurant, and at the other end the General Waiting Room. Opposite the ticket offices are the parcel checking counter and the package checking counter, each with a frontage of fifty feet. These are separated by a forty-foot entrance passage to the train waiting room, which is reached by passing down a broad, easy ramp. This room, though limited in height by the elevation of the tracks, will be 250 feet by 100 feet, and will be made attractive by the use of light-coloured durable materials, such as marble and glazed terra-cotta.

The design of the building was discussed in detail in our issue of May 6, 1914, and it remains only to say that the erection of the Union Station is but a part of a larger scheme which involves a total expenditure of fifteen million dollars. The greater undertaking is the building of a huge viaduct at a cost of twelve million dollars. It is not expected that the viaduct will start for some little time.

Optimistic word comes from Mr. C. H. Allen, General Manager of the Peter Lyall & Sons Construction Company. Mr. Allen states that within a month five hundred men will be employed on the new station, and that the work will go on, frost or no frost, so that everything is ready for the erection of the steel superstructure by the spring.



Proposed Union Station, Toronto. Main Booking Office.

In a report prepared by a special committee of the Structural Association of San Francisco it was stated that sulphur, as such, will probably not attack iron or steel reinforcement in concrete, but when oxidized and in the form of H_2SO_4 there is little doubt as to its destructive properties. Corrosion may be set up by concrete containing coke breeze aggregate. Although no weakening of the embedded steel may be developed for years, the latent danger of such aggregate is a serious matter.

Combined Fire Station and Recorders' Court at Maisonneuve, Que.

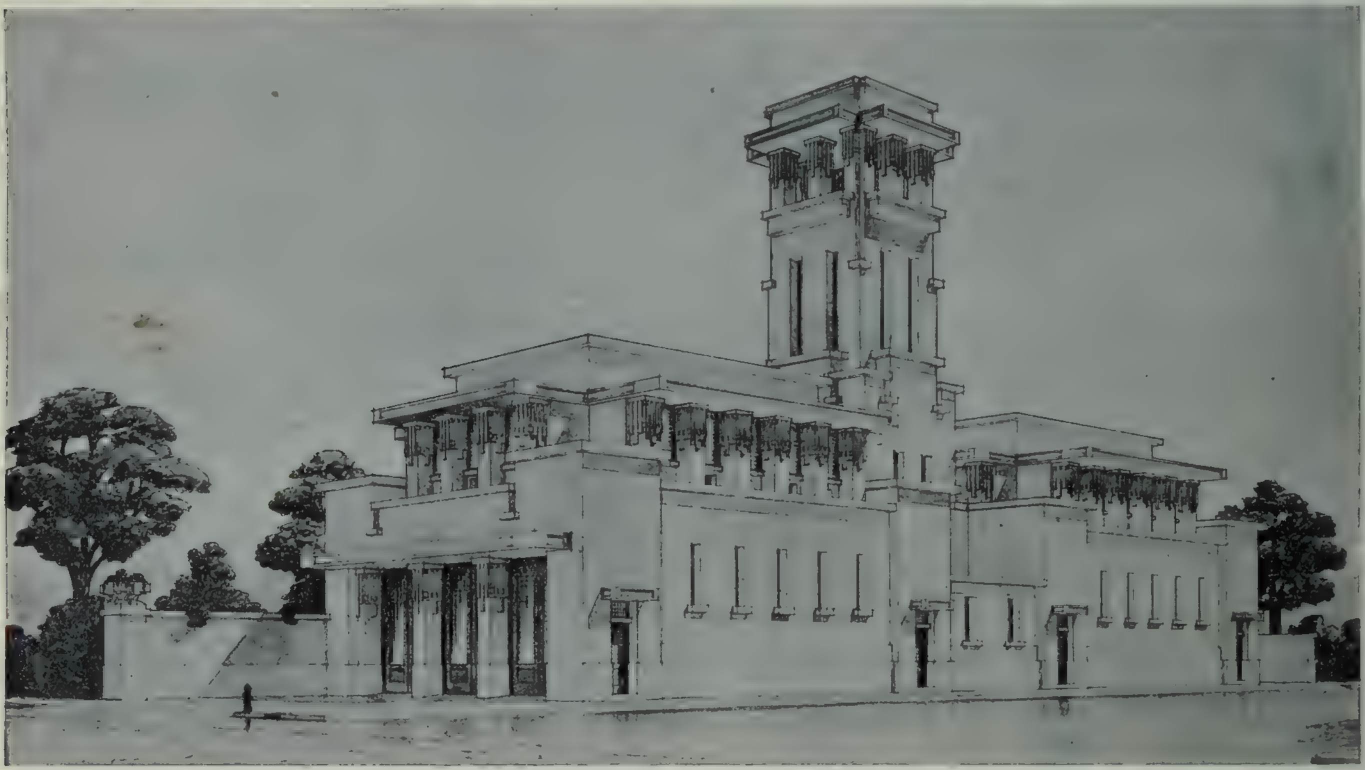
At the corner of Notre Dame Street East and Letourneux Avenue, the city of Maisonneuve, P. Q., is just completing a combined fire station and recorders' court, built from plans by Mr. Marius Dufresne. The site is 48 x 209½ feet, the actual building being 48 x 167½ feet. The structure has a very solid appearance, and has two or three interesting features. There are a basement and two storeys, with a very large tower for drying hose reels and for observation purposes. The foundations are of concrete; the exterior is of Deschambault limestone constructed on a steel frame; the mitoyen wall is of Greendale Rug brick, and the floors are of reinforced concrete.

The basement, which is 8 feet high and built below the level of the street, is to be used for automobile repairs. The tower, which is in the centre of the building, commencing in the basement and rising 87 feet above the street level, is in the form of an open square 18 feet wide on each side, and is constructed to a height of 67 feet from the street level, when the observation portion commences. This portion is reached from the hose tower by means of a ladder. The observation roof is supported by eight limestone pillars, a parapet running round the observation tower. The entire tower is made of limestone, faced on the interior with white enamelled brick.

The space for the motor fire-fighting apparatus is in the front section of the ground floor, the main entrance, on Notre Dame Street East, being through wide doors with automatic springs. This space is 56 x 44 feet. A part of the same floor is occupied, on the Letourneux Avenue side, by offices for the Chief of Police, on either side of which is an entrance, one leading to the fire station and the other to the recorders' court. The walls of the vestibules have chestnut wainscoting panels. The Chief of Police's quarters are finished in oak wainscoting and plaster walls. Next to these quarters is the tower, and on the north side lavatory accommodation.

A machine shop occupies the east side. This will be equipped with lath and boring machines, run by electricity, a trap being provided for lowering heavy pieces into the basement. The Judge's room and witnesses' room, with toilet annex, communicate with the recorders' court, which is situated on the south side of the ground floor. The court room has chestnut wainscoating panels, with painted plaster above this. The walls are of panelled plaster with plaster cornices in old ivory colour. At the far end are the prisoners' cells, four on the ground floor and six on a mezzanine floor. These have lavatory accommodation, with automatic taps, all the plumbing being enclosed, so that it cannot be tampered with. The entrance to the cells is on Letourneux Avenue, where there is also a watchman's office. On the other side of the cells, next to the mitoyen wall, is a police patrol garage, which is reached from Letourneux Avenue by a passage 22 feet wide and 48 feet long. Communication with the basement from the ground floor is by two stairways, one in a corner of the tower and the other in front of the prisoners' cells.

The second floor is devoted to dormitories, gymnasium and shower-baths. Immediately facing the front of the building are toilet rooms for officers, and behind are the firemen's dormitories, 46 x 30 feet.



Fire Station and Recorders' Court, Maisonneuve, Que.

Leading off from these on either side are exterior terraces, 6 feet wide, with parapets of limestone. On the east side are the shower baths, toilets, and a skylight to give light to the machine shop below. A passage-way alongside the shower-baths leads to the gymnasium, on the side of which are further exterior terraces. At the extreme end are toilets for officers, and an additional terrace. The dormitories have Terrazzo floors, enamelled brick walls, and plastered ceilings. In the toilets the wainscoatings are of marble, with enamelled brick above to the ceiling, which is of plaster, while in the gymnasium the walls are of enamelled brick and the ceilings of plaster. The flat roof is of asphalt mastic cement.

Most of the work was carried out by Mr. C. Lalonge, Maisonneuve. The concrete foundations were constructed by day work. Mr. I. Allard, Montreal, supplied the windows and doors; Lymburner, Limited, Montreal, the special apparatus for opening the front doors and the suspension for drying the hose in the tower; and Webster & Sons, Limited, Montreal, the Greendale Rug brick. The following were the sub-contractors: electrical work, Canada Electric Company, Montreal; mastic cement, F. Simms, Montreal; brick-work, J. A. Savard, Montreal; steel structure, Dominion Bridge Company, Lachine; plumbing and heating, Caron & Surprenant, Maisonneuve; iron work, Canadian Architectural Ironworks, Montreal; plastering and glazing, D. Lalonge, Maisonneuve; tiling and marble work, Lepage Marble Works, Montreal.

IN the recent excavation for the foundations of the new buildings of the Phoenix Assurance Company in King William Street, near old London Bridge, numerous Roman remains possessing a high degree of interest to antiquarians were brought to light. The excavations extended considerably below the basement of the old structure, which was only 10 feet beneath the pavement level, and it was on digging down to a further depth of five feet that the upper surface of the deposits was reached. Most of these relics were present in strata of earth from three to five feet in thickness, and were distributed fairly evenly. At the same time a number of pits were revealed which had evidently been dug by the Roman builders for the purpose of obtaining brick, earth, and gravel. The relics consist in the main of Roman pottery fragments, such as dishes, cups, and bowls of glazed Samian ware, and numerous coarse vessels of unglazed earthenware in the shape of "amphorae" and "mortaria" for storing liquids and for cooking purposes. Hardly a single piece was found to be intact, but several had only sustained slight damage, and these, as well as the fragments of others which were in a more serious condition, have been put together so that many almost complete specimens are the result. The portion of the city in which these relics were found was probably the earliest area occupied by the Romans, and the interesting suggestion has been made that they belonged to the fort constructed on the north bank of the Thames in the year 43 A.D.

What is probably the long distance record in placing concrete by the pneumatic method, was made recently in connection with the Mile Rock tunnel work in San Francisco Bay, when the mix was conveyed 2,805 ft. through a 6-in. pipe. The air compressor capacity installed was 1,200 cu. ft. a minute, and the receiver pressure was kept at about 115 lbs. the sq. in.

Method of Striking Off Wide Concrete Street Pavements and Those Having a Varying Crown*

SOMETIMES a contractor is called upon to place concrete pavement on a short stretch of very wide pavement where the construction of a satisfactory strikeboard to span the full width would cost more than the size of the job warrants. An instance of this kind occurred at Chrismann, Ill., where the following method was successfully used. The plan may be easily modified if necessary.

Assume the pavement to be either one or two-course construction, reinforced, and with steel-protected joints placed from 25 to 30 ft. apart. Figure 1 assumes the pavement completed to the joint at AF, the installation bar removed and mixer in the position M, work progressing in the direction shown by arrow C. At the points D and E, midway between the joint AF and the position of the next joint BG, stretch a string from curb to curb. Drive a row of 2 x 2-in. oak stakes of correct length (depending on the kind of subgrade) along the line DE and spaced 5 ft. apart, centre to centre. Drive these stakes with their top 2 ins. above the grade of the finished pavement as determined by the use of a set of three sighting T's. The amount that the top of the centre T must be dropped in order to set the stakes at the proper elevation for each point can be calculated, or obtained by stretching a chalk line from end to end of one of the installation bars provided for the job, first measuring from the line to the centre of the bar to see that its crown is correct and then measuring ordinates from the line to the bar every 5 ft. along the line. These ordinates plus 2 ins. must be subtracted from the amount of the crown and this remainder used as a guide to set each stake to the proper elevation. Set the two stakes next to the curb at D and E first, at the proper elevation, and use them to support the two plain sighting T's when setting each of the other T's in the line DE. Fig. 2 suggests the construction for the centre T, which will allow the top to be dropped the predetermined amount for setting each stake.

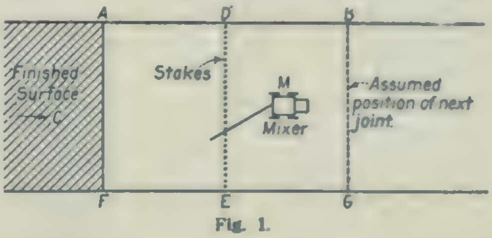


Fig. 1.

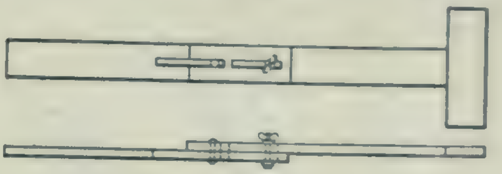


Fig. 2.

Having driven this line of stakes to the proper elevation, proceed to place the first course of concrete and reinforcement, carrying it several feet past the line of stakes toward BG. This first layer will, of course, be kept down below the tops of the stakes an amount equal to 2 ins. plus the thickness of the wearing course. If the workmen are not expert at levelling off the concrete it will be of advantage to drive as many stakes as are necessary in the area ADEF to be used simply as a guide to placing the concrete to the proper thickness. These of course can be pulled out as concrete is placed.

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*By H. Colin Campbell in Engineering and Contracting.

Across the top of the stakes in the line DE nail 2 x 4-in lumber with the 4-in. side flat. It is preferable to use 2 x 4's of a length equal to one-half the width of the street, as the long pieces will curve more readily to the crown of the street than will shorter ones. A lap joint should be made over a stake to make close joints over which the strikeboard will ride.

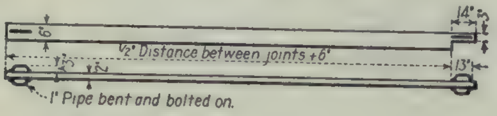


Fig. 3.

Next commence placing the top course at one side of the pavement, say at AD, striking off, as placed, from AD to FE. Fig. 3 shows the type of strikeboard which will be used. The operation of striking off is as follows: One man holds the strikeboard at the B-end (Fig. 1) and stands facing the joint AF, working the straightedge with both hands. Another man standing at the right of the joint AF, and facing the curb AD, works the straightedge with one hand. The straightedge is given a sawing motion, backward and forward, at the same time it is being moved ahead towards FE. As the workman at the A-end is always walking backward, his tracks in the concrete will be filled in by the material being struck off.

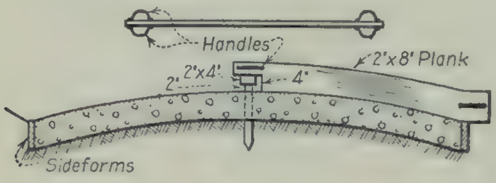


Fig. 5.

Two men spreading concrete from the bucket also keep the material correctly distributed in front of the straightedge and care must be exercised to see that there is always a small surplus heaped against the board, sufficient to fill in all low places. Note that as the "screed" is nailed to the top of the stakes, which are driven to 2 ins. above grade, its lower face is above the surface of the pavement and therefore does not tend to form a line of weakness in the pavement such as would be caused if it were allowed to be embedded with its top face level with the surface.

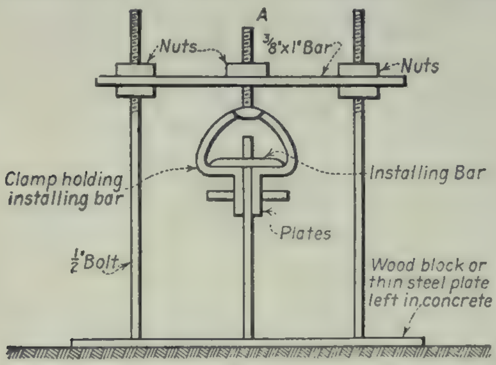

A
Nuts
⅜"x1" Bar
Nuts
Clamp holding installing bar
Installing Bar
Plates
½" Bolt
Wood block or thin steel plate left in concrete

Fig. 7.

Assume that the area ADEF has not been struck off. Next place concrete to within 2 or 3 ft. of BG, then place the joint with its installing bar (joint having been prepared as noted below) and place concrete for the entire thickness of the pavement and reinforcement 2 or 3 ft. past the joint. Strip off the installing bar and strike off the pavement as before, reversing the strikeboard, end from end, resting the notched end on the "screed" and the other end on the joint, taking care to see that the footmarks of the men working the end of the board at DE are always filled up.

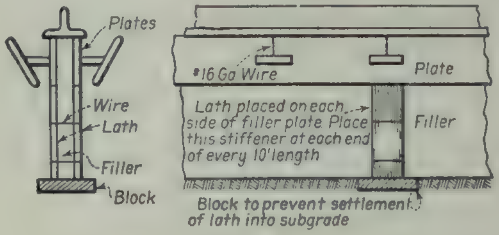

Plates
Wire
Lath
Filler
Block
#16 Ga Wire
Plate
Lath placed on each side of filler plate Place this stiffener at each end of every 10' length
Filler
Block to prevent settlement of lath into subgrade

Fig. 4.

Very particular care should be exercised by the workmen to see that footmarks in the top surface are completely filled with good dense concrete and not with fine "soup" and water. If the latter happens there is a likelihood that a small pocket will be left in the surface at these places when the water evaporates. Even if this is not the case, the fine material at this spot will not wear as well as the remainder of the pavement and later may cause a hole to develop.

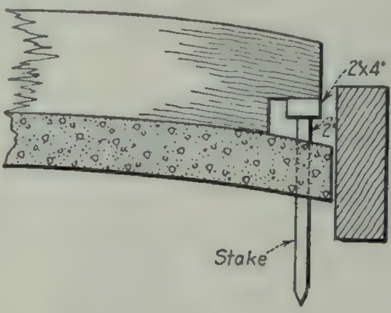


Fig. 6.

After the section is struck off the "screed" and stakes are removed by a man working from a bridge, the holes are filled and the surface levelled off, if necessary, with a small straightedge about 5 ft. long.

If the width of the street and the size of the job do not warrant the construction of a bridge to span the whole street, 1 x 12-in. boards may be placed along the centre line to support the ends of two bridges, each half the width of the street in length. These 1 x 12-in. boards should be cut to about 6-ft. lengths so that as the bridges are alternately moved ahead they can be removed and any marks left by them floated out at once.

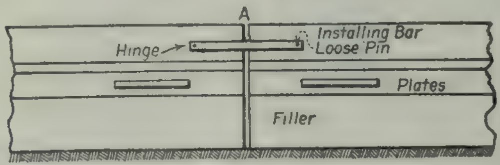


Fig. 8.

Fig. 4 shows a means of stiffening the felt filler of the joint at the centre, ends, quarter points and other places if necessary, of the pavement, so that it will bear the weight of the strikeboard without sagging.

The pieces of lath shown should be wired tightly to the felt and fit snugly up against the lower edge of the plates. In addition, the protection plates should, of course, be made to conform exactly to the proper crown of the pavement and should be wired together at the top edges with No. 16 gauge malleable iron wire every 12 ins. along their length.

The above described method is applicable to any width of pavement. The method described below is applicable to pavements up to about 35 ft. in width, and is especially applicable to those pavements which are laid out with a variable crown—that is, pavements in which the crown increases from summits to inlets in order to provide for gutter drainage where the ground is flat and the centre line of the pavement must be given a flat grade.

Before placing concrete a line of stakes is driven along the centre line of the pavement 4 x 5 ft. apart with the top of the stakes 2 ins. above the top surface of the finished pavement. Concrete with reinforcement is then placed to approximately the proper thickness and a 2 x 4 lightly nailed to the top of the stakes as in the foregoing method described.

Fig. 5 shows a strikeboard cut to conform to the pavement crown as noted below, for use if the pavement is not provided with curbs where the side form can be used to guide the outer end of the strikeboard and the 2 x 4 mentioned above is used to guide the inner end.

If curbs are provided and are such that the exposure of the curb face varies from summits to inlets, another guide strip placed at the gutter similar to the centre guide strip as shown in Fig. 6 must be used. This strip must be set on a line parallel to the grade of the gutter. The strikeboard shown only strikes one-half of the pavement; two such strikes may be used or one used on each side of the pavement alternately. The strikeboard should be worked with a sawing motion.

For pavement with a variable crown having a miximum crown at inlets and a minimum crown at summits, the strikeboard should be cut to the average crown of the pavement. Running the outer end of the strikeboard on the guide strip set parallel to the gutter grade will take care of the variable crown. Likewise the protection plates and installing bar for these pavements should be given the average crown. The installing bars and plates should be ordered in two sections, each section being of a length equal to one-half the width of the pavement. A connection for hinging the two half installing bars together is easily made by bolting a ½ x 1½ x 8-in. strap to one installing bar as shown in Fig. 7. The bars are connected after the joint is assembled in each and the bars placed in position by inserting a pin through the other bar. Enough space must be provided between bars at A to allow for setting the ends of each joint at the proper elevation.

Each installing bar is supported at the centre by a device shown in Fig. 8, which can be made by any blacksmith at a small cost.

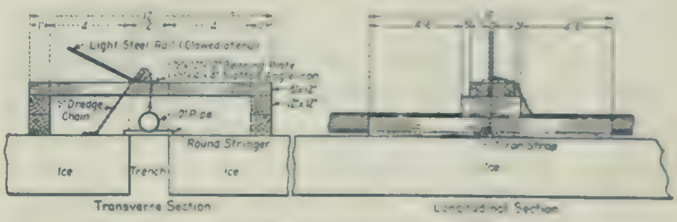
When ready to remove the installing bars, remove the nut and pull the frame, consisting of the two ½-in. bolts and cross bar. The clamp remains on the installing bar. The holes left by pulling the bolts are filled with concrete and floated over.

This method satisfactorily solves the problem of striking off a concrete pavement with a variable crown.

Method Employed in Lowering Water Intake Pipe through Ice

A somewhat novel method employed in lowering the water supply intake pipe into the waters of Cedar Island Lake, at Gilbert, Minn., last winter is described by a correspondent of Engineering and Contracting. The city is installing a filtration plant and it was thought best to lower the raw water intake during the winter. The work was started during February and after much sounding the right depth of water was found at about 800 ft. from shore. The ice was about 3 ft. thick. A trench was cut through the ice to a uniform width of 2 ft. The pipe was rolled to the edge of the trench. A staging, such as illustrated herewith, was erected every 35 feet, round stringers were placed cross-wise of the trench and the pipe was rolled upon them. The pipe employed is 10 ins. in diameter and is coated with a Matheson coating. It came in 20 ft. lengths with screw joints, and a flange joint every 100 ft. A circular band of 1 in. strap iron was passed around the pipe at each staging and the lowering chain was engaged in a hook at the upper part of this band. The chain was pulled taut and slipped in the slot of the angle iron shown in the sketch.

Owing to the fact that two windblowers were attached at the off-shore end of the pipe a tripod and a 5-ton block and chain were erected over that end, and two snub ropes were also used to keep the windblowers perpendicular. Three men were used at each staging, one to work the angle iron and the other to operate the lever.



Sketch illustrating method of lowering water intake pipe.

The night before the pipe was lowered the stringers were removed and the pipe was allowed to fill with water so that it would go down when the chains were slackened. The next morning the lowering began. A foreman stood at one end of the line with a megaphone and, at the word from him, each man at an angle iron allowed the chain to slip down two links. In this way the entire pipe line was lowered at the same time and it was not given a chance to sag. The shore end had to go down about 2 ft. while the off-shore end had to go down about 30 ft. As the shore end went down the chains slackened as the pipe reached the bottom and sunk into it. In three hours from the beginning of the lowering operations every chain was unfastened and pulled up. The pipe sunk about 1 ft. into the sandy bottom within two weeks, after it was lowered.

Major G. T. Hurst, M.S.A., of the 3rd (Natal) Mounted Rifles, Durban, has returned to England from late German, now British South-West Africa, where he was engaged with his regiment in assisting General Botha to alter the colour scheme of the map. "His criticism on the architecture there, where it existed, is," says the Society of Architects' Journal, "that it is too awful for words, and typifies the coarseness and aggressiveness of the German colonial character —swinish, with hardly a redeeming feature."

LETTERS

An Opportunity for Municipal Engineers

Editor, The Contract Record:

During the lull in constructional operations municipal engineers might give some time to the re-organizing of their maintenance departments with a view to producing sane economy. Generally there is plenty of room for obtaining useful statistics from the Garbage and Health Departments. The cost of work could be examined into, and possible reductions considered.

With the co-operation of the Treasurer the municipal engineer could also find out what assets a city had on its hands in the way of improvements and other undertakings carried out for the city or town. These assets should be thoroughly overhauled, and all the work should be re-surveyed and valued so that the city would know that the assets were absolutely up-to-date. In most cases the assets are underestimated, and some are omitted entirely.

Yours truly,

J. W. B. BLACKMAN.*

New Westminster, B.C.,
September 29, 1915.

The Insurance of Office Tenure

Details of Operation in England

Editor, The Contract Record:

While I agree that conscientious officials in some towns and cities in Canada should have a measure of protection, it seems to me that Mr. Blackman's scheme opens up a very big question—one which requires fuller explanation. In my opinion it would be difficult to bring such a scheme to a successful issue, and it would be hard work to draw up conditions that would meet every case.

Mr. Blackman states that the insurance plan has been successful in England. In Canada, of course, conditions are entirely different. Perhaps Mr. Blackman could furnish The Contract Record with full particulars of the scheme as carried out in England. These might then be discussed, and provide some sort of basis to work upon.*

Yours truly,

GEORGE REAKES,
(Town Engineer, Beaconsfield.)

Beaconsfield, Que., Sept. 29, 1915.

* * *

Conflicts with Charter Powers

Editor, The Contract Record:

I have read with considerable interest the suggestions regarding the proposed insurance of office tenure. The present charter powers issued by all cities and municipalities enable them to employ and dismiss at pleasure. The one month's notice which they are required to give applies to city engineers, their subordinates, and the general rank and file throughout a municipal organization.

I do not think that any company would undertake insurance in a manner financially advantageous to those seeking it. If the proposition were at all feasible under the charter powers to which I have referred I feel confident that there are live insurance men who would be glad to promote such a scheme as you suggest.

I am not one to throw cold water on any scheme likely to secure to engineers the advantages you have discussed, for I fully realize the unsatisfactory relation existing between municipal engineers and their councils; they have no security for their services, and they are subject more or less to the wishes of elected representatives of the people who at best are only in temporary control. At the same time I cannot see that it would be wise or profitable to bring forward a matter of such importance as the insurance of office tenure unless there were a good fighting chance of carrying it to a successful issue.

Yours very sincerely,

F. L. FELLOWES
(Supervising City Engineer, Vancouver.)

Vancouver, Sept. 29, 1915.

* * *

A Matter for the Canadian Society

Editor, The Contract Record:

The letter relating to the Insurance of Office Tenure, and also the editorial comment in your issue of September 15, are suggestive of discussion.

As you point out in your editorial, the details in connection with Mr. Blackman's scheme would have to be worked out very carefully. Putting myself in the place of the employer, I can see so many ways in which any action involving the dismissal of an employee can be reasonably justified that it seems almost impossible to frame regulations that would be generally satisfactory. It appears that each case of dismissal would have to be investigated by an official from the guarantee company—a man competent to judge each case on its merits. A man of the required calibre would necessarily be a high-salaried one, and as there is no doubt that there would be a lot of work along this line, it seems that the rate suggested is inadequate.

If this matter has not been referred to the Canadian Society of Civil Engineers, I would suggest that it be done, as an opinion from the Society would be of great value.

Yours truly,

G. D. ARCHIBALD
(City Engineer, Saskatoon.)

Saskatoon, Sask., Sept. 25, 1915.

* * *

Not Adapted to Canadian Conditions

Editor, The Contract Record:

Judging from my own experience, I must say that I have not the same confidence in the success of an insurance scheme in this country as Mr. Blackman appears to have.

The cases where men occupying municipal or other responsible positions are dismissed from office without just cause, or through political or other motives, are so scarce that few would care to take out a policy to insure against dismissal. The majority of young men who have gone to the trouble and expense of educating themselves for good positions do not take a post with a view to permanency, but with the idea of obtaining experience to fit themselves for higher positions, or to work themselves into the class of employers instead of employees. Insurance of office tenure would have little attraction for ambitious young men aspiring to the higher positions in their chosen profession.

In conclusion I would say that while such a scheme of insurance might work out successfully in Great Britain, where there is a surplus of men qualified for the positions offering, it is altogether different in a country like Canada, where there is such a variety of lucrative work awaiting men capable of doing it. I do not think that such a scheme of insurance would be successful either in Canada or the United States.

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* Mr. Reakes' suggestion is met—in part, at any rate—by the specimen policy published on page 1041 of this issue.—Editor.

Yours truly,
OWEN McKAY
(Town Engineer, Walkerville, Ont.)
Walkerville, Ont., Sept. 21, 1915.

* * *

No Redress at Present

Editor, The Contract Record:

In regard to the matter of the insurance of office tenure, I would say that I do not think Mr. Blackman's suggestion feasible, and I question whether any insurance company would take it up except on payment of very heavy premiums.

I am afraid that this uncertain tenure of office is one of the drawbacks to municipal work which engineers will have to bear with until the public can be educated to a better appreciation of their services.

Yours truly,
C. H. RUST
(City Engineer, Victoria.)
Victoria, Sept. 27, 1915.

* * *

Derogatory to Profession?

Editor, The Contract Record:

Mr. Blackman states in his letter published in your issue of September 15 that cases of unjust dismissal are few. I will go further, and say that cases of unjust dismissal are practically unknown. I have noticed in past years that all cases referred to me as unjust were, when carefully gone into, cases of just dismissal, or they arose out of a necessary reduction in the staff. However, if the actual unjust dismissals are few, as mentioned in Mr. Blackman's letter, why organize an insurance against hardly probable cases? Who shall judge whether a dismissal is just or unjust? Would not such an organization be derogatory to the profession? Do you not think it more important first to protect civil engineers (municipal among others) against civic employees who are engineers only because of the title which appears opposite their names on the city pay-rolls? If only fully qualified civil engineers were employed by the cities, the few cases of unjust dismissal would be still fewer.

Yours truly,
PAUL E. MERCIER
(Deputy Chief Engineer of Public Works
for the City of Montreal.)
Montreal, Sept. 24, 1915.

The Licensing of Engineers

The Pros and Cons

Editor, The Contract Record:

In response to your invitation for an expression of opinion concerning the question of licensing engineers, I have to state that this important matter has been engaging the attention of engineers in many parts of the world for a considerable time.

Engineering is a profession just as much as law, medicine and surveying, but when the conditions of the professions are analyzed it will be found that although law, medicine and surveying have several branches or divisions, these branches are more or less alike. Medicine, for instance, has to do with the health, comfort and happiness of man, and while it is divided into distinct sections they are all concerned with more or less the same problem, although there are branches for specialized work. So far as can be discerned at present, there will not be any great changes in future. There will be great developments in medicine, surgery, bacteriology, but always tending towards the same object. In the engineering profession, however, while it is as ancient and as honorable as any other, it has during the last fifty years been divided into many new lines of activity. Civil engineering formerly comprised everything except military work, but to-day national engineering societies find it necessary to make distinct divisions, and some branches have become sufficiently important to have powerful organizations of their own. As time rolls on no doubt other divisions will take place. Electrical, chemical, aeronautical, illuminating, and forest engineering are relatively new professions. Gas, railway, marine, highway, sanitary and town engineering were professions in long clothes less than a century ago. They are distinct in functions and often have little in common.

While the laws respecting the harnessing of the forces of nature, and the principles of construction are the same in all branches of engineering, the applications of these fundamental truths are so extensive and the uses made of them are so dissimilar that it is almost impossible to appreciate the extent of the ramifications of the engineering profession. Furthermore, some of the different sections are often so interlocked and intimately associated one with another that the line of demarcation cannot be fixed; and the exchange of materials and parts of a construction involve the work of different engineers, some of whom may be in other parts and free from control.

If engineers are to be licensed where is the business to begin? Clearly it will not be possible to legislate for the wholesale licensing because the opposition and upheaval will be too much to overcome, while it would be discriminating against a section to deal with one at a time.

As Prof. Young and you have pointed out, the Illinois law for the licensing of structural engineers is not quite satisfactory. What is meant by "structural engineer"? Ordinarily the term is applied to those engaged on steel structures, but he who designs a dam across the St. Lawrence River or a condensation basin for a power house is equally a structural engineer. Limit in magnitude of a work is difficult to fix, because it is easy enough to divide certain schemes into sections so as to evade the law.

According to the Illinois law those practising as structural engineers at the time it was promulgated are licensed without examination. This is the usual result of law making. It cannot be made to act retrogressively. Time will cause the elimination of this class. If licensing is to be carried out in Canada similar provision will have to be made, because otherwise it would inflict grievous injustice on some practitioners. To admit existing practitioners by examination or investigation would scarcely meet the situation. When the Saskatchewan Architects' Act was passed those in practice at the time were admitted. When the draft act was being drawn for South Africa—with which the writer had a little to do—similar provisions had to be made. Prof. Young deplores this unsatisfactory state of affairs, but it is difficult to see how it can be dealt with otherwise.

Licensing, per se, is desirable, in many respects. It is a source of protection to the profession and to the public. It places the holder of the license on a higher plane and sets a hall-mark of quality on his skill. But the examination, to be of real value, must be made by absolutely disinterested parties. Readers can no doubt recall instances of candidates in other lines who were granted certificates by "friends," but who would otherwise have had in their own interest to sit again. Granting of unmerited certificates will degrade a profession and destroy public confidence. A favorite phrase of U. S. General Scott for such a case was "pruriency of fame which was not earned."

Examinations have been known to be stiffened so as to choke off candidates and thereby reduce the number of practitioners.

Licensing would tend to reduce competition, to bring engineers under discipline of councils, and make the profession a sort of trade union.

We need self-protection, combination, co-operation, and the raising of the status of engineers. Will licensing effect this desirable improvement?

There are good arguments to advance in favor of and against licensing, but at present the writer does not feel justified in expressing a decided opinion either way.

Yours truly,

R. O. WYNNE-ROBERTS.

Toronto, Oct. 1, 1915.

" Engineers . . . Should Contrive to Strive for . . . the Legal Establishment of Their Profession "

Editor, The Contract Record:

I have read with a good deal of interest Prof. C. R. Young's letter on "The Licensing of Engineers," and your editorial comment thereon, in your issue of the 22nd inst.

More than twenty years ago the question came up before the Canadian Society of Civil Engineers and was thoroughly discussed in all its bearings. It was realized that though a civil engineer was just as useful a member of society as a doctor or a lawyer, or a member of any other profession, and while he had to go through just as thorough and severe a training, it was a fact, and an anomaly, that he had no recognized legal status. While a man who had no medical training could not lawfully call himself a doctor, or a man without legal knowledge advertise himself as a barrister, any man was free to call himself an engineer, without let or hindrance, and the profession of civil engineering, one of the noblest of all professions, had no place or recognition in the laws or statutes of the country. There was no recognized or authoritative means of discriminating between the trained and competent engineer and the ignorant humbug and pretender.

A committee of the Society was therefore formed. Every member of the Society was consulted by circular letter, and expressions of opinion were sought from men whose opinions were valuable. While some members thought the time was inopportune, and the difficulties were almost insurmountable in the way of legislation, the Society was practically unanimous as to the desirability of some statutory recognition of the profession, with the ultimate objects, not only of protecting the individual, but of raising the standard of qualification, and of protecting the public from unqualified men and quacks.

The net result of all this discussion and deliberation was a Bill, drafted under the advice of the best legal and parliamentary talent in the country, for presentation in the different provincial legislatures of the Dominion. This was necessary, because, under the British North America Act, federal legislation on these lines would be ultra vires in the provinces.

The measure has become law in the provinces of Quebec and Manitoba.

In Nova Scotia it was passed by the House of Assembly in February, 1897, but turned down by the Legislative Council, or Upper House, as the result of some unexpected opposition that developed in the mining fraternity, owing to what I believe was a misapprehension in regard to the scope and objects of the Bill.

The main feature of the Bill, and the one which appeared to excite the most opposition, not merely in Nova Scotia, but, as I believe, in other provinces also, was that a man was not entitled to call himself a civil engineer, or to practice as such, unless he was a member of the Canadian Society of Civil Engineers; but this surely is not an unreasonable provision.

In every province of the Dominion there is a medical society and a barristers' society, in which every practitioner must be duly enrolled and registered before he can write a prescription, address a jury, or collect a fee.

If the ablest physician or barrister in Europe or the United States were to settle in Canada and attempt to practice his profession, he would fall into the clutches of the Medical or Legal Society of the Province in which he settled, and find himself under the necessity of perhaps passing an examination, but at any rate, of registering his name and qualifications on the Society's books, and of paying certain legally prescribed fees and dues.

Plumbers, horse-doctors and druggists, too, must be duly licensed by law and statute before they can make their living in their respective callings.

But the unfortunate Civil Engineer, where is he? The laws and statutes know him not. Nobody seems to know or care whether he is qualified or unqualified, competent or incompetent, registered or nameless. The man who has spent years and dollars in technical and scientific education is no better off than the man who does not know a logarithm from a log of wood; the man who knows not his right hand from his left, lands on our shores from Europe or the United States, and calls himself an Engineer (we have seen him) and he is an Engineer to all intents and purposes. The Government, Provincial or Municipal, the Corporation or the Capitalist, that employs an Engineer to design a bridge or a system of water-works has to take the Engineer's word that he is a competent man, that the bridge will not fall down, and that the water-works will supply water.

The operation of the Act in the provinces of Quebec and Manitoba has not been without its drawbacks, because a certain number of men have had to be admitted to membership in the C.S.C.E. who are Land Surveyors, rather than Civil Engineers, and the difficulty of drawing a hard and fast line between these two classes is recognized as a very real one.

The only cogent argument that I have heard against the establishment of the profession of Civil Engineering on the same legal footing as other learned professions, is the fact that in England, where the profession is probably on a higher plane than anywhere else in the world, it has no legal status, but there the Institution of Civil Engineers is practically, though not nominally, supreme, and unless a man is a member thereof he is not recognized as an Engineer, and has little or no opportunity of practising the profession.

So far as I am aware, the subject has not of late years engaged the attention of the C. S. C. E., but it certainly should do so, very earnestly.

After more than twenty years of serious consideration, I am still of the opinion that the Engineers of Canada are entitled to, and should continue to strive for, the due and proper recognition and legal establishment of their profession.

I should like to give you, at some future time, the history of the—so far unsuccessful—efforts that Engineers in the employ of the Federal Government have been making for more than a dozen years, to establish an Engineering Service on similar lines to those fine services in India and Australia. It would take several columns of your "Record," but it would be interesting reading.

Yours truly,
C. E. W. DODWELL.
M. Inst. C.E.
M. Can. Soc. C.E.

Halifax, N.S., Sept. 27, 1915.

* * *

Sympathizes Strongly with Illinois Enactments

Editor, The Contract Record:

I should be in favor of any general regulations that would make for the raising of the standard of engineering practice in Canada, and I should prefer regulations on a Dominion rather than on a Provincial basis.

Other learned professions have very strict laws to insure that unqualified men shall not be admitted to practice. Why should it not be a benefit to the engineering profession to have a similar law? While it is true that examinations and certificates will not guarantee efficiency, it is at least true that examinations will prevent absolutely ignorant men from claiming qualifications which they do not possess. The clause in the Illinois law qualifying all existing practitioners is a very reasonable one, and it is a provision that is usually necessary in initiating any restrictive measures. It might admit a few unqualified persons, but this is an abuse that cures itself in a generation, which is a term of very little moment in the adoption of a permanent general principle. My sympathies are very strongly with the Illinois legislation.

Yours very truly,
WM. P. ANDERSON
(Chief Engineer, Department of
Marine and Fisheries.)

Ottawa, Sept. 25th, 1915.

* * *

No Legislation Satisfactory Unless From Federal Government

Editor, The Contract Record:

I have read with interest Prof. C. R. Young's letter in reference to the enactment of a license law for engineers. I am of opinion that the idea is no more in favor now than it was twelve years ago. Provincial legislation regulating engineers would be useless under any circumstances, and no legislation would be satisfactory unless it came from the Federal Government. I have not heard of anyone desiring a license system. If such a faction exists it would be interesting to know why they require such regulation.

Membership in our national engineering society should be, and is, as good a guarantee of ability as is required, and if those employing engineers would insist on this qualification it would avoid all talk of legislation. Certainly if the Federal and Provincial Governments would set the example it would do good to the profession.

Yours truly,
HENRY HOLGATE.

Montreal, September 29, 1915.

Tools and pails that have become thickly coated with concrete can be cleaned by heating. A gasoline torch will aid in removing concrete from mixers and other large equipment.

Insurance of Office Tenure—Specimen Policy

FURTHER in regard to the proposed insurance of office tenure for civic employees, discussed in our issue of September 15, the promoter of the scheme, Mr. J. W. B. Blackman, City Engineer of New Westminster, has forwarded to The Contract Record the copy of a policy which was sent him for perusal by the Secretary of the Official Security Company, Limited, London, England. In writing to Mr. Blackman the Secretary of this firm offers any assistance possible in the formation of an association, and states that his company might be able to arrange for some of the underwriting.

The Specimen Policy

OFFICIAL SECURITY, Limited
Head Office: 21 Spital Square, Bishopsgate, London.
SECURITY OF TENURE POLICY "A"

Policy No. .... Case No. ....
Limit of Sum Insured £ ....
WHEREAS ....
(hereinafter called "the Insured") of ....
.....................holding the office of ....
.... in the service of ....

for the purposes of this Insurance has made to OFFICIAL SECURITY LIMITED (hereinafter called "the Company") a written Proposal and Declaration containing certain particulars and statements which it is hereby agreed shall be the basis of this Contract and be considered as incorporated herein.

NOW THIS POLICY WITNESSETH that in consideration of the payment to the Company of the sum of £ .... as the premium for the following Insurance from twelve o'clock noon of the ....day of .... 19 until twelve o'clock noon of the .... day of .... 19 . and the payment of the premium for any subsequent period in respect of which the Company shall accept a renewal premium, the Company shall, during the continuance of the Insurance, and upon and subject to the Conditions hereinafter contained, Indemnify the Insured against:

LOSS OR DIMINUTION OF OFFICIAL SALARY of the said office through causes beyond the Insured's own control, or for arbitrary reasons not justifying dismissal without notice at Common Law, or owing to reduction of staff, or owing to legislation abolishing the office of the Insured or reducing the salary thereof.

PROVIDED ALWAYS that this Policy shall not Indemnify the Insured against loss or diminution of official salary.

(a) Owing to misconduct or causes justifying dismissal without notice at Common Law.

(b) Resulting from strikes or voluntary withholding of services, or from active participation in parliamentary or municipal politics by canvassing for votes, or acting on any political committee or otherwise taking active part in parliamentary or municipal elections where the conduct of the Insured is not expressly approved in writing by the Company.

(c) Owing to non-acceptance of reasonable but newly-imposed regulations of employers, regulations requiring devotion of whole time to duties of office, or residence in district of local authority and regulations of a similar nature, regulations imposed by other local authorities and acquiesced in by their officers being deemed to be reasonable within the meaning of this provision.

(d) Through bankruptcy, insolvency, or the making of a composition with creditors, or inability to provide usual guarantees or insurance of fidelity.

PROVIDED ALSO that the Company's liability under this Policy shall not in any event exceed the sum of .... Pounds (which sum is hereinafter referred to as "the sum hereby insured.")

The conditions above referred to are as follows:

1. The Insured upon becoming aware of any motion or proposal to dismiss him or call upon him to resign, or to reduce his salary, shall immediately give notice thereof in writing to the registered office of the Company, and shall supply to the best of his ability full particulars on and in the terms of the form provided by the Company, and shall take all usual and proper steps, and render to the Company's agents every assistance in his power in taking steps, to defeat such proposals in proper cases, and shall not tender his resignation in pursuance of a demand unjustified at Common Law without the consent of the Company.

2. The Insured shall, at the request of the Company, sign a statutory declaration that he has not consented to, or connived at, or arranged for, the termination of his appointment, as a condition precedent to the payment of any claim under this Policy.

3. The consideration for this Policy must be actually paid to the Company before any liability of the Company commences hereunder. The Company shall not be bound to accept any renewal of this Policy beyond the term agreed to by them and by the Insured in his proposal, or any extension thereof authorized by the Company, but the Company may at any time during the said term, if the Insured by his own acts or defaults or habits of life is jeopardizing his position or has exceeded sixty-five years of age (unless he is specially approved by the Company as efficient beyond that age), give fourteen days' notice to the Insured to determine this Policy as from the date of the expiration of such notice, and thereupon the Insured shall be entitled to the return of a proportionate part of the last premium paid by the Insured in respect of the unexpired term of this Policy. But such determination shall be without prejudice to any rights or claims of the Insured or the Company prior to the expiration of such notice.

4. No alteration or erasure in this Policy or the conditions thereof, or in the printed form of receipt (other than the substitution—if necessary—of the word "she" for the word "he" or the word "her" for the word "him" or "his," as the circumstances may be) shall be valid unless the same be signed by the Governing Trustee of the Company and the Secretary or other duly authorized official of the Company.

5. The Insured shall not disclose to his employers the fact of his being insured against loss or diminution of official salary.

6. The Insured shall, and will, at all times exercise reasonable care, diligence and courtesy in the discharge of the duties relating to his office or employment, and shall avoid friction in his relations with his fellow officials and employers, and shall in all other respects endeavour to avert complaints to his employers, or hostile action by them in respect of mistakes. In the event of its being shown to the Company that the behaviour or habits of the Insured in or about the execution of the duties of the Insured in connection with his office or employment are likely to give rise to a motion or proposal to dismiss him or call upon him to resign, or to reduce his salary, it shall be lawful to the Company to give notice in writing under this condition to the Insured and thereupon all liability of the Company under this Policy shall be suspended until the Company are reasonably satisfied that the behaviour or habits of the Insured have been improved or are justifiable in the circumstances of the case.

7. The Company will pay claims or the balance thereof after making the deductions hereinafter mentioned, by quarterly instalments, each instalment being one-third less than a quarter of the yearly salary of the Insured, as stated in the proposal form, until the sum hereby insured with such deduction as aforesaid is paid.

8. The Company may deduct from any claim hereunder:

(a) Compensation for loss or diminution of salary to which the Insured is entitled under statute, or from his employers, or otherwise, which, if payable by way of life annuity or pension, shall be capitalized at the sum required to purchase from H. M. Postmaster-General a life annuity of the same amount. Provided that if the Insured is entitled to compensation by way of return of contributions or life annuity or pension under any superannuation, thrift, or provident scheme under the Metropolis Superannuation Act, 1866, or to which he has contributed, the Company may only deduct from any claim hereunder so much of such compensation (capitalized in the case of a life annuity or pension in manner aforesaid) as shall exceed the amount of one year's salary of the Insured as stated in his proposal form.

(b) One-half the net earnings received by the Insured (beyond those receivable before the loss or diminution of salary occurred, and otherwise than from the office lost or affected) during the period over which the sum insured hereby is payable, such earnings to be verified by statutory declaration of the Insured at the end of each quarter if so required by the Company at their expense, and the Company may deduct such half of the said net earnings from the next or any succeeding instalment of the sum insured, payable after the close of the quarter during which they were earned.

(c) The costs and expenses incurred by the Company in any arbitration hereunder which have been awarded to the Company, and which are payable by the Insured.

9. The Insured shall use his best efforts and take the usual steps for earning his own living after such loss or diminution of official salary has occurred. In the event of the Insured declining any offer of suitable employment made by the Company or other persons, or failing to take proper steps for obtaining employment, the Company may apply to any member of the Company's Board of Arbitrators, after one month's notice to the Insured to make such deduction from the sum hereby insured in respect thereof as, having regard to all the circumstances of the case, may appear just and equitable to the Arbitrator.

10. This Policy shall be void and all premiums paid thereon forfeited to the Company (a) if the proposal contains any misrepresentation or material ommission, or (b) if after the insurance has been effected the risk be increased from any cause whatsoever without in every case the assent or sanction of the Company, being signified by endorsement thereon, or (c) if the Insured shall fail to comply with any of these conditions.

11. Should any difference arise between the Company and the Insured as to the extent or meaning of this Policy, or as to any obligation or liability hereunder, it is hereby agreed that such difference shall be referred to the decision of a member of the Company's Board of Arbitrators to be selected by the Insured under the provisions of the Arbitration Act, 1889, the Arbitration Scotland Act, 1894, or such

other Arbitration Act as may at the time apply to such difference, and it is expressly stipulated that the making of an award by such Arbitrator shall be a condition precedent to any right to recover by legal proceedings.

12. It is hereby declared that none of the Trustees or officers of the Company shall be personally responsible for the payment of any monies under this Policy which are chargeable only upon the funds and assets of the Company.

For and on behalf of the Company this ....day of

.... 19 .

.... Trustees.

....

..........................., Secretary.

Examined ....

Entered ....

The Importance of Organization

A Discussion of Germany's Strong Point: the Application of Science to Industry.

ORGANIZATION was a subject which came in for special emphasis by Prof. Hele-Shaw, F. R. S., in a recent address delivered in London before the engineering section of the British Association. In his reference to the systematic development of organization in Germany, Prof. Hele-Shaw is most interesting. We extract the following:

"When you speak of organization to most people they immediately seize upon some small feature which may be to them of more immediate interest. It may be the general arrangement of their accounts, their system of storekeeping, of dealing with their workmen, of the sales department, or fifty other minor details. If you take this narrow view of organization, you will, of course, at once say that a scientific man has very little to do with it, and, indeed, the manufacturer, as a rule, thinking of his works organization, scouts the idea that a man of science can either know or have anything to say about it which is of any value.

"Let me therefore take the dictionary definition. To organize is to "arrange or constitute interdependent parts, each having a special function, act, office, or relation with respect to the whole." If we accept this definition, which, as a matter of fact, we must, there is no question as to the all-important nature of organization, for you will notice that there are two outstanding things, the first "interdependent parts," and the second their "relation to the whole." Thus the subject of organization really includes the whole of industry. It includes science and its relation to manufacture; it includes the relations between the employer and employee; it includes the workman, and his attitude towards new devices, labor-saving appliances, and output; it includes the whole question of the supply of raw materials, and even the sale and delivery of the finished article. Taking these different features, is there any doubt that the man of science in this country can hold his own, and more than hold his own, with that of any other? The history of invention is quite enough to give a final answer to this question. Again, the British employer and man of affairs has always shown himself individually in the forefront of enterprise; as for the workman himself, he is admitted, in the matter of intelligence, physical endurance, and skill, to have no superior; while with regard to materials for manufacture, and the power of delivering goods, it need scarcely be said that the British Empire, if we take it as a whole, is the richest country in the world in raw materials, and its means of delivery of its goods is expressed by the enormous preponderance of its mercantile marine.

"When we come, however, to these interdependent parts and their relation to the whole, it is there that we find the weak joint in the armour. It is in this respect that Germany can teach us a striking lesson in the arrangement of these interdependent parts with respect to the whole. From the top to the bottom the whole forces of their industries are so thoroughly organized that they get all that is humanly possible out of the various factors. I do not limit this merely to the wonderful organization of any works, like Krupps, or the Deutsche Machinenfabrik, or hundreds of other works; but I include the organization of all the Government departments, together with the banks, the railways, and the shipping, so that every facility is afforded for the world commerce of the German Empire.

"Taking only one of these details, I remember when at Liverpool, and the battle of the Manchester Ship Canal was being fought, what facts came out as to the difficulties in the transhipment and handling of goods. The late Mr. Alfred Holt, for instance, was one of the most earnest in pointing out that the want of co-operation and organization in getting goods from our manufacturing centres was adding largely to their cost, and actually exceeded the cost of transporting these goods across the ocean. In Germany, on the other hand, the Government steps in, and, by means of special differential rates gives the manufacturer every facility, and the lowest possible rates for obtaining raw material and delivering the finished goods to all parts of the world. It was this organization that not only rendered Germany so formidable a rival in times of peace, but makes her so powerful in war.

"This co-ordination in Germany is carried out in every industry in a way we generally have little idea of. For instance, the other day, at a deputation to the Government, Mr. Runciman remarked that the difficulty of connecting the manufacturers with the commercial staffs in this country is deep-seated, but perhaps not altogether incurable. Further, that the manufacturer must realize what he can get from the universities, and the university must know what the works require. Dr. Foster, the treasurer of the Chemical Society, also said that 'the Germans were so imbued with the need of pursuing modern and efficient methods of education in applying science to industry that they hold in contempt a country which notoriously neglects such processes'; and he attributed this contempt as partly contributory to their cheerfulness in entering into war with us.

"Now, while these remarks are undoubtedly true, they are only a part of the truth. The evil is far wider than in any special application, for, as the German knows perfectly well, there are innumerable individual cases of organization in this country of equal efficiency to any in his country, and he is glad enough to learn from special cases. Let us take one, and I do so because it shows that the man of science is capable of industrial and manufacturing organization, if he turns his mind to it. I refer to the case of the firm of Barr and Stroud, Limited. As you know, the founders of this firm were originally colleagues in the Yorkshire College (the former, Professor Barr, occupied the presidential chair of this section three years ago), and they together invented a range-finder. Now, whatever the merit of this range-finder, it is safe to say, like every other important invention—for instance, the Parsons turbine—that the invention alone would have stood a small chance of coming into practice. In fact, to make the invention is, as a rule, the beginning of the difficulty. Professors Barr and Stroud, however, set to work to carry their invention into practice, and did so with such effect that their works, which began on quite a small scale, rapidly grew. The first part of the new works was opened with about ninety hands, all told, in 1904. In the course of ten years it has increased to such an extent that there are now 1,700 employees. Those of us who have visited the works at Glasgow know the almost perfect way in which the whole arrangements are made, not merely for the scientific side, but for the comfort of the men, including the working dress, which in itself becomes a uniform. It gives some idea of the scientific side to know that there are at the present moment twenty-three men with university qualifications, most of them with university degrees, and many of them men who were absolutely the first on the college list in the final examinations. This industry is another illustration of the lead given to Germany by this country, because the Barr and Stroud range-finders were brought out before any of the German range-finders of the kind now being made, the Germans having followed in their lines and copied them in many respects. I have enlarged upon this, because I cannot help pointing out that the Barr and Stroud range-finders have had no small effect in the marvellous precision of our naval guns, and it will no doubt pass through your minds what we owe to private enterprise, which started the manufacture of the turbines, range-finders, guns, and other naval features, when we think of such battles as those off Heligoland or the Falkland Islands.

"The other day Field-Marshal von Moltke stated, and there is no reason to disbelieve him, that, great as was the storage of ammunition and shells before the war, the enormous demand far exceeded all expectation, and Germanv found herself for a time in the same plight as her enemies; but he further stated that Germany's emergence from this dangerous position was largely due to the extraordinary organization, which included not merely the adaptation of their factories for munition purposes, but capacity for work of the people, and the patriotic spirit of the German workmen."

Special Details in Reinforced Concrete and Steel Building Construction

ECONOMY has become the most important factor in present-day building construction: it determines almost without exception the size, the type and the design of every building. Hand in hand with it, as a great aid, comes standardization of material and methods. The size of all building materials has been well standardized, and steel of any except the standard shapes and minimum weights is not obtainable except on special and very expensive order. The most efficient engineer designs accordingly. Details involving the use of special material, special shop work, etc., are used by him only as the last resort. Any work out of the regular line of materials and methods that the ordinary workmen is acquainted with becomes very expensive, and the contractor studies religiously to avoid such, and when he finds a different solution he insists on its use, or an allowance of extra time to obtain the material detailed.

However, every building does have features which require very careful attention. Every building has certain parts designed for an unusual purpose, which neither the specifications nor the general drawings explain adequately to the contractor and to the various craftsmen employed in its construction. Throughout the entire building there are details of construction on which two or more separate crafts must be agreed. For example, the location of terra cotta anchor holes in the steel frame is vital to both steel and terra cotta contractors, yet neither may establish it for the other. Details of such items in the work do, and should, form a large part of the special details in building plans. The following enumeration, classified in a very general way, covers the principal subjects for detail usually required:

Reinforced Concrete Construction

(a) Design of footing reinforcement.
    1. Bending of reinforcing bars.
    2. Location and size of shear reinforcement.
    3. Disposition of bars in tension face of heavy cantilever or combined footings.
(b) Detail of column base, showing dowels in footing, method of securing vertical bars, and hooping in the case of hooped columns.
(c) Detail of column splice in reinforcement, and disposition of slab reinforcement around column.
(d) Location of all brackets.
    Anchor bars.
    Hangers, shafting, etc.
    Pockets in slab or column.
    Holes in slab for mechanical equipment.
(e) Location in slab for pipes of steam fitter, plumber, electrician and other mechanics.

Steel Skeleton Frame

(a) Detail of column base (steel grillage or cast iron base).
(b) Connection of frame to foundation, anchor bolts, etc.
(c) Column splice and typical beam connection.
    Location of splice.
    Material in same.
    Material for beam connections.
(d) Location and detail layout for all wind bracing in the building.
(e) Design of plate girder with:
    1. Line diagram of girder to scale.
    2. Loads designed for.
    3. Stresses.
    4. Material, lengths, etc.
(f) Design of trusses with:
    1. Line diagram of truss.
    2. Panel loads, designed for.
    3. Stresses in each member.
    4. Material.
    5. Lateral bracing, etc.

The details of the footing and column bases in the reinforced concrete work are essential largely because they are needed at the beginning of operation in the field, at the stage when the contractor's organization is not acquainted with the design or scope of the work, and extra care to make the beginning clear to them is well worth the effort in the time gained.

The location of brackets, etc., called for in item (d) is intended to eliminate, so far as possible, one of the objectionable features of reinforced concrete work, as it is not easy to add to or alter anything about the structural frame, after it is erected. Machinery brackets on columns, for example, are so easily forgotten and so hard to attach afterward that a

Provincial Normal School, Victoria, B.C.

separate and elaborate detail for them is a wise precaution.

The location of pipe holes in the slabs is important. Usually a slab is hardly dry before every craft on the work starts to cut away at it. Seemingly pipes have never been thought of before that time. Not only is disregard for these dangerous to the construction, but it is expensive to cut through a 6 or 8-in. concrete slab to provide space for a pipe. This expense must in the end be borne by the owner. When one reflects how comparatively easy it would be for the designer to locate these holes in the plans in advance of the pouring it seems all the more serious that it is done so infrequently.

Most of the items in the steel framing are self-explanatory, but mention may well be made of plate girder and truss design. A great many designers record their designs for plate girders and trusses in a private notebook, and give very meagre data on the plans. A single cross section through a plate girder is often considered sufficient for the detailer. The material list accompanying such a drawing is of little value to the man who must order the material for the girder. He finds it necessary to duplicate nearly all the work that the designer has recorded in his notebook. A small line diagram, if only to ⅛ in. scale, showing dimensioned lengths of all members of the girder, is easily added to a drawing, and such a diagram makes it possible to order the material for it without delay.

So many items appear for each building under these various headings, and attention at the proper time means so much to the men who execute the work, that they deserve thorough study. He is indeed a valuable man in any office who can indicate clearly every difficulty in the way of the workmen and can avoid the use of special materials, special tools, or expensive operations.

Hydrated lime to the amount of 0.1 cu. ft. to each 1 cu. ft. of cement is to be used for all concrete in the culverts, bridges, and pavements of the 6½-mile section of the Coleman du Pont Road in Sussex County, Delaware. A concrete pavement is now being constructed in Somerset County, Maryland, under the direction of Mr. Henry G. Shirley, Chief Engineer of the State Roads Commission. In this a percentage of hydrated lime is also used.

The Provincial Normal School at Victoria

THE new Provincial Normal School at Victoria occupies an ideal location on a seven-acre site. The contract for its erection was awarded in June, 1913, and work on the foundations was commenced the following month, the building having been turned over to the Government in January of last year. The site and building represent an expenditure of some $250,000. The structure is thoroughly fireproof, it being of reinforced concrete, with facings of red pressed brick, trimmings of Denman Island stone, and slate roof. A feature of the design is a central clock-tower, ninety-five feet high, the base of which merges into the elevation of the principal entrance, which is finished in terrazzo tile. For the interior finishing Douglas fir and other B. C. woods have been used. The equipment includes a system of low-pressure steam heating, exhaust ventilation, vacuum cleaning plant, gas plant, automatic temperature control electric time system, and an inter-communicating telephone system.

On the lower floor there are a gymnasium, 73 x 35 feet, recreation rooms, heating and fuel chambers, store rooms, lavatories, baths and dressing rooms, with plunge and shower baths for both sexes, luncheon rooms, manual training, masters' rooms, cycle rooms, games and storage rooms, and janitor's rooms.

An auditorium, 73 x 35 feet, with gallery, platform, anterooms, four students' class-rooms, three model scholars' class-rooms, principal's and teachers' rooms, two music rooms, secretary's office, cloak and locker rooms, library, store and stock rooms, lavatories, etc., occupy the ground floor.

On the first floor are situated four class-rooms, clay modelling, art, science, lecture and preparation rooms, optical dark rooms, biological, chemical and physical laboratories, balance and storage rooms, masters' rooms, lavatories, etc.

The contractors for the Normal School were Messrs. Luney Brothers, of Victoria, while the building was designed by W. C. F. Gillam, of Vancouver and Victoria.

The Toronto-Hamilton Highway

ON Thursday of last week, a party consisting of Mr. George H. Gooderham, Chairman of the Toronto-Hamilton Highway Commission, members of the Commission, the Ontario Motor League and representatives of The Contract Record and other sections of the Press inspected the work now being done on the construction of the Toronto-Hamilton concrete roadway.

Starting at Clarkson, where the most easterly section of concrete ends, the party went over the whole of the road as far as the outskirts of Hamilton, and were agreeably surprised by the progress made and the fine quality of the road already laid.

Mr. H. S. Van Scoyce, Chief Engineer, Toronto-Hamilton Highway.

The completed highway will be about 35 miles long. Of this, eleven miles have been concreted to date. The greater part of the remaining distance has been graded ready for the concrete, the principal exception being that stretch through the town of Burlington, where work has been rendered impossible by the construction of a sewer.

The Commission have accomplished excellent work in eliminating many bad turns and in limiting the maximum grade to four per cent.

Some idea of the magnitude of the undertaking will be gathered from the statement that 150,000 tons of stone, 75,000 tons of sand, and 125,000 barrels of cement will be required. With regard to the sand, considerable difficulty has been experienced in obtaining a steady and adequate supply. The materials are received at the yards at Port Credit, Oakville and Waterdown, unloaded into cars of one and one-half cubic yard capacity by a locomotive clam-shell bucket crane, and hauled to the roadway by dinkey engines over 24-inch gauge track, of which there are twenty miles laid.

The concrete is mixed in cube mixers in the proportions 1:1½:3, the water being pumped from the lake by four pumps and carried along the roadway in 2-inch pipe. The road-bed is levelled soil, and the concrete is laid direct on to this subsurface. It is 6 inches thick at the edge and 8¼ inches at the centre, and is floated to a smooth surface. The road is then covered with damp earth, or ponded and covered with water, in order to keep the concrete moist for a period of about ten days. In those places where the width exceeds 18 feet, causing the thickness of the concrete in the centre to become excessive, the sub-surface also is given a crown, and the concrete is reinforced with wire mesh. A unique feature of the road are the integral curbs which are being constructed through the municipalities, the curbs and road being entirely homogeneous.

The progress made on the highway is extremely creditable when the numerous obstacles are taken into account. Not the least among these are the weather conditions which have been encountered. Concreting did not start until July 21st, and from that date until the end of August the weather was wet, with little cessation. Apart from the retarding effect of this upon the work, it caused other troubles in the form of washouts at various places. However, the Chief Engineer, Mr. H. S. Van Scoyoc, is hopeful of completing about twenty miles of concrete work by the end of the season.

The total cost of the work done to date is $210,000, and the debenture issue amounts to $600,000. Of this sum, the city of Toronto contributes $150,000, and Hamilton $30,000, the Provincial Government paying a subsidy of $4,000 a mile and the various municipalities through which the road passes another $4,000 a mile, the balance of the cost being obtained on a frontage basis.

The entire work is being carried out by day labor, under the supervision of the Engineers, the number of men employed varying from 375 during the winter to over one thousand in the latter part of the summer.

It will be readily understood that the commissariat arrangements are no inconsiderable part of the work. The excellence of the catering was abundantly demonstrated by the luncheon tendered to the members of the party at the Oakville camp.

Personal Mention

Mr. J. W. Leonard has been re-elected General Manager of the Toronto Terminals Railway Company.

Mr. Donald Bain, the Toronto contractor, who died at Muskoka in August, left an estate valued at $33,640.

Pro Patria

Capt. E. E. Williams, Manager of the London Branch of the Dunlop Tire and Rubber Goods Company, Limited, had been connected with military work for upwards of eleven years at the time of his joining the Colours, and he had been employed by the Dunlop firm for nine years. When war broke out he was one of the first to offer his services. He volunteered with the first Canadian contingent, and went to

Captain E. E. Williams.

the front as Captain in the Canadian Army Service Corps. Capt. Williams has a wife and two children living in the Forest City.

Mr. R. H. Murray, of the engineering staff of the Saskatchewan Bureau of Public Health, has received a commission in an English military unit called the "London Sanitary."

Mr. A. E. MacGregor, who has been Resident Engineer at London, Ont., for Messrs. Chipman & Power for the last two years, was married last week at Bowmanville, Ont., to Miss Alice McTaggart Martin.

Prof. Alexander Miller Gray, Assistant Professor of Electrical Engineering at McGill University, Montreal, has been appointed Professor of Electrical Engineering in Sibley College, Cornell University.

Mr. J. G. Sullivan, Chief Engineer of the Canadian Pacific Railway, has been attending the International Engineering Congress at San Francisco, representing, with Mr. J. Challies, of Ottawa, the Dominion at this great gathering. Engineers have been in attendance from practically every country in the world—except Germany and Austria.

Mr. J. G. Sullivan, Chief Engineer of the C.P.R., one of Canada's representatives at the International Engineering Congress at San Francisco.

Major E. G. M. Cape, of E. G. M. Cape, Limited, Montreal, has been appointed to the command of a new heavy artillery battery for overseas service. Major Cape has taken charge of the recruiting.

Mr. Collingwood Schreiber, C.M.G., General Consulting Engineer of the Department of Railways and Canals, together with Mr. L. K. Jones, Assistant Deputy Minister, left Ottawa last week on a semi-annual inspection trip through the West as far as the G. T. P. terminal, Prince Rupert. Mr. Schreiber, who is now 84 years of age, has been making these trips practically since the commencement of railway building in Western Canada.

Mr. C. E. Henderson, Assistant City Engineer of Port Arthur, has been appointed City Engineer of St. Augustine, Florida. Mr. Henderson graduated in civil engineering at the University of Illinois in 1906. For some years he had a varied experience in railway and other constructional work. For a time he was Instructor of Civil Engineering in the University of Illinois. He has been Assistant City Engineer of Port Arthur since June, 1910.

Mainly Constructional

East and West—From Coast to Coast

Eugene DesOrmeaux, Limited, contractors, Montreal, Que., have obtained a charter.

The Darlington Gravel Company, Limited, Bowmanville, Ont., capitalized at $40,000, has been incorporated by L. W. Reade, C. R. Stein, J. B. Mitchel, and others, of Bowmanville.

A newly-incorporated Montreal concern is the Harris Heating and Engineering Company, Limited, whose capital is $25,000. J. A. Harris, Edgar Desy, and M. Raymond are among the incorporators.

Operations have started on the erection of the new Church of the Holy Name on Danforth Avenue and Moscow Street. The new building was designed by Mr. A. W. Holmes, architect, Toronto.

At a meeting of the Canadian Society of Civil Engineers to be held in Montreal on October 7th, Mr. R. F. Hayward will contribute a paper on the "Stade Falls Development of the Western Canada Power Company."

Sorel Steel Foundries Company, Limited, has been incorporated with a capital of $100,000 to take over the business of Messrs. Beauchemin & Son, Limited, at Sorel, Que. The incorporators include L. P. Tremblay and N. Latraverse, both of Sorel.

The contract for a pipeline estimated to cost $194,000 has been awarded by the Ottawa City Council to Messrs. Laurin & Leitch, of Montreal. The engineer in charge of this undertaking is Mr. R. L. Haycock, and the consulting engineer Mr. J. B. McRae, of Ottawa.

The contract for the flooring for the St. Denis Theatre, Montreal, has been awarded to the Marbleloid Company, through their representatives, Messrs. Archibald & Company, 302 Shaughnessy Building, Montreal. This contract embodies all the traffic portions of the theatre, the area being 15,000 sq. ft.

According to the local press, bricklayers at Calgary have surpassed all the other building trades in the number they have sent to the Colours. It is stated that out of 165 members of the Calgary Bricklayers, Masons and Plasterers' Union over sixty, or more than forty per cent., have enlisted for active service.

Things are humming at the Canadian Car and Foundry Company's plant at Amherst, N.S., where seven hundred men are now employed. The busy section of the plant is the steel shop, where box cars, structural work, and so on, are being turned out in large quantities. The machine shop is working day and night, two shifts being employed continuously.

A report from Hamilton, Ont., states that the proposed new bridge at the Valley Inn Hill will cost not less than $500,000 if erected in concrete, and considerably more if built of steel. Soundings were renewed recently, and rock was finally found at a depth of ninety-one feet. It is questioned whether it would not be more economical to resort to filling than to erect a bridge.

With the acquisition by the Canadian Government of the Transcontinental line between Moncton, N.B., and Winnipeg, it has been decided to change the location of a part of the Intercolonial Railway right-of-way near Moncton, to avoid duplication of tracks. About ten miles of I. C. R. track will be abandoned, and the track of the Transcontinental will be used instead. The steep grade, known as the Catamount grade, besides some smaller grades, will thus be eliminated. It has been suggested that the abandoned right-of-way might be used for highway purposes.

The Bathurst Street Hill improvement at Toronto, which was opened recently by the Mayor, Mr. Church, cost rather more than $225,000. Operations were commenced in January, 1914, and the undertaking was completed a short time ago. Formerly the maximum grade on the hill at the steepest part was 14.2 per cent., but now the heaviest grade is 7.94 per cent. The length of the retaining wall is 949 feet, and the roadway varies in width from 42 to 46 feet. The yardage of brick laid is given as 6,866.

A meeting of the Nova Scotia Steel and Coal Company's directors was held at the head office at New Glasgow, N.S., last week. In a statement submitted by the General Manager it was shown that the output in shells for September was the largest ever made, it having been forty per cent. over that of August. The orders on hand were equal to six months' full capacity of the plant at its present high rate of production. The wages paid by the company in their steel plant at New Glasgow alone are at the rate of $150,000 a month—by far the largest in the history of the company.

Following the completion of the New Brunswick Government's spandrel arch bridge at the Falls, St. John, the wooden suspension bridge, which has been in use since 1853, is now being removed. All the central woodwork has been taken away, and there now remain only the wire cables and the four large granite towers from which the bridge has been suspended. With the removal of the old structure there passes a bridge which has done loyal service for the province. At the low estimate of two thousand a week, at least six and one-half millions of travellers have passed over this bridge since it was erected.

With a view of properly training men in the oxy-acetylene process, the Montreal Technical School, 70 Sherbrooke Street West, is holding winter night classes. The elementary course is on Friday night for ten weeks from 7.30 to 9.30, beginning October 8th, the advanced class beginning in January next, and also lasting for ten weeks. Theoretical and practical lessons (the latter in a fully equipped workshop and with individual benches) will be taught by experts in English and French. In Europe, and also in the United States, this process is taught as part of the regular course in the engineering schools. At the Montreal Technical School the courses have the support of L'Air Liquide Society, Maisonneuve, who are naturally interested in the turning out of efficient and well-trained men.

Borings are being made on the St. John River, at Mistake Point, to determine the character of the bottom and the practicability of a railway bridge to carry the tracks of the Valley Railway down the eastern side of the river to St. John. At the point under survey, the river has a width of 1,900 feet, with a maximum depth of 60 feet. It is proposed to carry the line from Mistake Point to Gorham's Bluff, thence across the mouth of Gorham's Creek, where the water is from 9 to 11 feet deep, to Shamper's Landing, on the Kingston peninsula. A direct route can be obtained by tunnelling 1,500 feet, at an estimated cost of $150,000, to Kingston Creek, or the creek can be entered by curving the line around Shamper's Point. From this locality it is probable that the survey will be carried through to the Intercolonial Railway, connecting with the Government road at a point between Jubilee Station and Rothesay.

The recent hurricane and storm which swept the Gulf of Mexico did great damage to houses along the sea-wall in Galveston, Texas. Sheet metal roofs came out of the storm with flying colors, very few sustaining any damage. Slate roofs suffered the greatest damage, with tile roofs next Roofs with asphalt shingles, and composition paper roofs, proved their worthlessness, and all were completely destroyed. The standing seam metal roofing and the metal shingle roofs made the best showing of all. When a metal shingle roof was damaged, it was by a falling chimney, and hundreds of them were not hurt even then. One of the houses had a telegraph cross-bar across its roof and suffered no damage whatever, as it was covered with metal shingles.

Trade Notes

From the Metallic Roofing Company of Canada, Limited (Toronto), we have received a pamphlet setting forth the claims made on behalf of Metallic Silo roofs. The company strongly recommend the "Empire" roof, as being weather-tight, fireproof, efficient, and moderate in cost. Simplicity of erection, and the protection it provides against the elements, are additional advantages of this roof.

In connection with the underground conduit system, the city of Montreal has installed a new lighting system on St. Catherine Street and Bleury Street. The lights, which are of the arc inverted type, are on iron standards of special design, the poles being spaced at an average distance of 125 feet. Messrs. G. M. Gest, Limited, supplied the standards, Eugene F. Phillips Electrical Works, Limited, the cable, and The Canadian General Electric the lights.

In a paragraph relating to the Bishopric Wall Board Company's exhibit at the C. N. E., published in our issue of September 8, it was inadvertently stated that the company's wall board was "inflammable." It is pointed out that while the materials used in the construction of Bishopric Stucco Board will burn, a wall made of this product covered with plaster is less liable to take fire than a lath and plaster wall. Where a wall is constructed by the use of Bishopric Stucco Board inside and out, the dead air space formed between the surfaces and the close adhesion of the material to the studding tends to prevent the spreading of fire. Bishopric products are not fireproof, as lath, paper and asphalt will burn, but it is claimed that the combination of the three as manufactured by the company affords a greater resistance to fire than ordinary walls. Bishopric products are slow to ignite, and slow burning.

Up to the present time there has never been any standard method of rating batch mixers. Some mixer manufacturers rate their machines by their capacity in mixed concrete, while other manufacturers rate them by their capacity in loose unmixed material. It is a well-known fact that a mixer having a batch capacity of 8-9 cubic feet of unmixed sand, stone and cement, will hold only about 6 cubic feet of mixed concrete per batch. For this reason the term three, four, or nine-foot mixer has never had any real, definite significance. The National Association of Mixer Manufacturers, at their August meeting, took steps toward remedying this difficulty by adopting a resolution providing for the uniform rating of batch mixers. This resolution provides that members of the association in future catalogs and circulars shall specify the capacity of their mixers as "size of wet, mixed batch," and not otherwise. The resolution further provides that the dry unmixed capacity of a mixer may be approximated as one and one-half times the wet mixed batch, assuming the use of cement, sand, and one and one-half inch crushed stone, with 1¾ gallons of water per cubic foot of mixed concrete. The members of the association further agreed not to use the dry batch rating in their correspondence, advertising, etc., unless the standard wet batch rating were used also and with equal prominence.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Berlin, Ont.
Work is about to start on the extension of the watermain on Courtland Avenue. Material will be purchased by Superintendent H. Hymmen.

Guelph, Ont.
The City Council are considering the construction of a storm drain on Gordon Street. Clerk, T. J. Moore.

Hamilton, Ont.
A recommendation for the construction of a drainage system in the northwest section of the city has been sent to the local and Provincial Boards of Health for approval. Work will start as soon as possible. Approximate cost, $35,500. Engineer, A. F. Macallum.

Lambeth, Ont.
The following contracts for the construction of a waterworks system have been awarded by the Village Council:—London Foundry Company, 369 Thames Street, London, contracts (a) and (b); E. Walter Engineering Company, Middlemarch P. O., contracts (c) and (d); Gartshore-Thomson Pipe & Foundry Company, Stuart Street W., Hamilton, supply of waterpipe; Des Moines Bridge & Iron Company, Pittsburgh, Pa., elevated steam tank; E. W. Kelly, Lambeth P. O., construction of concrete reservoir.

London, Ont.
The City Council have let the contract for the construction of a vitrified brick pavement on Wharncliffe Road and a sewer on Grey Street to the Fielder Construction Company, William Street, London, at $5,054.

The construction of a storm sewer on Grand Avenue is being considered by the City Council. Clerk, Samuel Baker.

The City Council contemplate laying asphaltic concrete pavements on Wellington and Clarence Streets. Engineer, H. A. Brazier.

Markham, Ont.
A by-law has been carried providing for the construction of a waterworks system, as proposed by Consulting Engineer E. A. James, 57 Adelaide Street W., Toronto. Work is expected to start shortly. Estimated cost, $20,000.

Monaghan Township, Ont.
The construction of sidewalks on Brown Street is contemplated by the Township Council. Clerk, B. Johnston, Peterborough.

Parry Sound, Ont.
The Town Engineer, George Murray, has been instructed to call for tenders on the construction of a sewer.

Peterborough, Ont.
The City Council are considering the laying of sewers on Robinson, Victoria and Aylmer Streets. Engineer, R. H. Pearsons.

Saanich, B.C.
Work on grading Shelbourne Street is about to start by day labor under supervision of Engineer D. W. Johnston, Royal Oak.

The proposed paving on Douglas St. and Gorge Road will be constructed by day labor under supervision of Engineer D. W. Johnston.

St. Thomas, Ont.
The Town Council will call for tenders shortly on the construction of a sewer on Walnut Street. Engineer, M. Ferguson.

Stratford, Ont.
The laying of concrete sidewalks on Mowat and Birmingham Streets is being considered by the Town Council. Clerk, R. R. Lang.

By-laws have been passed providing for the construction of tarvia pavements on Well, Church and West Gore Streets, and for a 9-inch sewer on Home Street. Engineer, A. B. Manson.

Victoria, B.C.
The City Council are considering the construction of a pavement on Blanshard Street. Engineer, C. H. Rust.

Welland, Ont.
Work has been commenced on the laying of a macadam pavement on Lundy's Lane by day labor. Approximate cost, $7,000. Road Superintendent, James Sheppard, Queenston.

York Township, Ont.
A report prepared by Township Engineer, F. Barber, 57 Adelaide Street E., estimates the cost of installing a water system in the district north of St. Clair Avenue and west of Yonge Street at $750,000. Work would include a 24-inch main on Eglinton Avenue, connected with 12-inch mains on Spadina Avenue, Bathurst, Dufferin, Kennedy, Lauder and Oakwood Streets and Vaughan Rd.

CONTRACTS AWARDED

Chateauguay, Que.
The Municipal Council have let the contract for laying macadam roads to Julien Toussaint & Company, 2743 St. Hubert Street, Montreal. Approximate cost, $6,000.

London, Ont.
The contract for laying sewers on Reyburn, Quebec and Salisbury Streets has been let by the City Council to John McMurphy, Hyman Hall, London. Approximate cost, $3,000.

New Glasgow, N.S.
The contract for the extension of the sewer on Trenton Road has been awarded by the Town Council to Chisholm & Company, New Glasgow.

New Westminster, B.C.
The contract for the supply of 4,000 feet of 14-inch rivetted steel water pipe has been let by the City Council to the Vulcan Iron Works, Front Street, at about $7,000.

Seneca Township, Ont.
The Township Council have awarded the contract for construction of concrete sidewalks to James Blake, Caledonia, Ont., at 9½ cents per square foot. Gravel will be provided by the Township.

Stratford, Ont.
The address of the Chicago Bridge & Iron Works, who have been awarded the contract for the construction of a standpipe, is Bridgeburg, Ont. Previous report incorrect.

Toronto, Ont.
The Board of Control have awarded the following contracts:—sewers on Chambers and Howick Streets, Longo & Gentile, 663 Markham Street, $1,580; Lansdowne Avenue, J. McGuire, 196 Spadina Road, $1,869; Prescott, Silverthorne and Turnburry Streets, Commissioner of Works, R. C. Harris, $4,638; asphalt pavement on Main Street, Godson Contracting Company, Manning Chambers, $20,572; Quebec and Bridgman Streets, Constructing & Paving Company, Confederation Life Building, $23,312; Alberta and Brdigman Streets and Goldwin Smith Drive, Commissioner of Works, $38,392; asphaltic concrete pavement on Wells Street, Constructing & Paving Company, Confederation Life Building, $5,641; brick block pavement on Pelham Street, Brayley & Nicholson, 61 Proctor Boulevard, Hamilton, $6,831; bitulithic pavement on Alton Street and Grace Terrace, Warren Bituminous Paving Company of Ontario, McKinnon Building, $30,696.

The following firms have been awarded contracts for sidewalk construction:—Grant Contracting Company, 50 Front Street E., Queen City Concrete Paving Company, 179 Broadview Avenue, Gardner Contracting Company, Goodyear Building, A. Johnson, 35 Burgess Avenue, Riverdale Concrete Paving Company, 256 Jones Avenue, Godson Contracting Company, Manning Chambers, Standard Concrete Paving Company, 187 Concord Avenue, Brayley & Nicholson, 61 Proctor Boulevard, Hamilton, and Commissioner of Works, R. C. Harris.

Windsor, Ont.
The contract for labor only required in the construction of watermains has been let to Reid & Murphy, Sandwich. Pipe has been purchased by the City.

Railroads, Bridges and Wharves

Calgary, Alta.
City Engineer G. W. Craig has reported that the cost of repairs to the Ogden Bridge would be about $14,000. Clerk, J. M. Miller.

Dover Township, Ont.
Tenders on the construction of two reinforced concrete bridges over the Gordon Drain will be received until noon, October 9th, by Commissioner James Fox, Electric, Ont. Plans, etc.,

at office of the Engineers, McCubbin & McGregor, 135 King Street, Chatham, and of the Clerk, John Welsh, Grand Avenue, Chatham.

Fort William West, Ont.
The Canadian Pacific Railway Company have been authorized to construct an industrial spur for the Western Terminal Elevator Company, Limited. Head office of the Railway Company, Montreal.

Kennebec Township, Ont.
Work will start shortly on the construction of a steel bridge 400 feet long across Big Cross Lake for the Department of Public Works and Frontenac County. Construction will be supervised by the Government Engineer. County Clerk, J. W. Bradshaw, Kingston.

Peterborough, Ont.
The Bonnacord Street Bridge will be built by day labor under supervision of the City Engineer, R. H. Parsons. Reinforced concrete construction. Approximate cost, $3,150.

Port Lambton, Ont.
The Department of Public Works, Ottawa, are preparing an estimate of the cost of constructing a public dock on the waterfront. Secretary, R. C. Desrochers, Ottawa.

Shipton Township, Que.
The Township Council are about to construct bridges over Clark Creek. Concrete work will be done by day labor. Approximate cost, $7,000.

Toronto, Ont.
The Grand Trunk Railway have been authorized to construct a branch line into the premises of the Toronto Harbor Commission east of the Don.

Vaudreuil, Que.
The Board of Railway Commissioners have authorized the Canadian Pacific Railway to construct an industrial spur for Curtis & Harvey (Canada), Limited, lots 5 and 6, Parish Rigaud, County Vaudreuil.

CONTRACTS AWARDED

Sandwich West, Ont.
The general contract for the construction of two concrete bridges for the Municipal Council has been let to Ernest Renaud, Sandwich.

Public Buildings, Churches and Schools

Calgary, Alta.
The Trustees of Calgary Roman Catholic School District No. 1 have been empowered to borrow $50,000 for the construction of three schools. Frame construction. Treasurer, A. Bernard MacDonald.

Fort William, Ont.
Tenders on the installation of fittings at the Examining Warehouse will be received until 4 p.m., October 14th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans, etc., with J. C. Stinson, Clerk of Works, Fort William, Thomas Hastings, Postal Station F, Toronto, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Long Branch, Ont.
The Architects for the school now in course of erection for School District No. 12 are S. B. Coon & Son, Ryrie Building, Toronto. Brick construction, stone trim, fireproof corridors and stairways. Approximate cost, $20,000.

Montreal, Que.
The following contracts have been let in connection with the conversion of the factory at 241 Guy Street into a barracks:—carpentry, William Evely, 449 Bleury Street; plumbing, Hickey and Aubut, 93 Dominion Street; tinting, James Shearer Company, Limited, 225 St. Patrick Street. Other work by day labor.

Ottawa, Ont.
The damage recently caused by fire at the Collegiate Institute will be repaired by day labor. Seating will be required. Architect, W. B. Garvock, Building Superintendent of Schools, Creighton Street.

Perth, N.B.
Equipment for the school now in course of erection will be purchased about December by the Secretary to the School Board, R. B. Ritchie.

Saskatchewan Province.
Tenders will be called shortly for the erection of a school for the Trustees of McCraney School District No. 3377. Secretary, Rowland Prescott, Kenaston. Frame construction.

Ste. Anne de Bellevue, Que.
Plans are being prepared for additions and alterations to the Parish Club House. Architect, G. A. Monette, Power Building, Craig Street, Montreal.

St. Remi, Que.
G. A. Monette, Power Building, Craig Street, Montreal, is preparing plans for alterations and additions to the Church. Stone construction, concrete foundation.

Three Rivers, Que.
The Department of Public Works, Ottawa, will receive tenders until 4 p.m., October 13th, for the installation of Post Office and Customs House fittings. Plans and specifications with the Architect, Charles Laford, Three Rivers, R. L. Deschamps, Central Post Office, Montreal, and at the Department. Specifications at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Toronto, Ont.
Tenders are now being received for cedar shingle, slate and asbestos roofing at the Church of Christ, 557 Bathurst Street. Specifications at 51 Richmond Street West.

Vancouver, B.C.
Tenders on the installation of interior fittings at Postal Station C will be received until 4 p.m., October 20th, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with the Postmaster, Vancouver, W. Henderson, Resident Architect, Victoria, and at the Department. Specifications at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

CONTRACTS AWARDED

Barrie, Ont.
The contract for electrical work at the Library now in course of erection on Collier Street has been let to the Barrie Electric Light Company, 5 Bayfield St.

Cardston, Alta.
The plumbing contract in connection with the school now being built has been awarded to Frank Summerton, Cardston.

Hamilton, Ont.
The general and roofing contracts for alterations to St. Mathews Church, Barton Avenue E., has been let to Mitchell & Riddell, Head Street. Brick construction, concrete and stone foundation, shingle roofing. Approximate cost, $5,000.

London, Ont.
The following contracts have been let in connection with the church being built on Maitland Street for the Congregation of the Latter Day Saints:—carpentry, P. H. Phillippian, 92 Chesley Avenue; steel, Sarnia Bridge Company, 176 North Street, Sarnia; asbesto-slate roofing, J. Bowles; plastering, W. Gould, 910 Lorne Street; heating and plumbing, L. J. Odell, 634 Princess Avenue; cement block, J. Banks, Queens Avenue. Painting and seating not yet awarded.

Montreal South, Que.
The general contract for the erection of a school in Rosemount Ward has been let to A. Filion & Frere, 2410 St. Denis Street.

Quebec, Que.
In connection with the chapel being built on Ste. Foy Road by E. Metivier & Son, St. Damien, County Bellechasse, the contracts for masonry, carpentry, roofing, plastering and painting have been awarded to the general contractors, and the heating, plumbing and electrical work to Vandry & Matte, 169 St. John Street.

Rothsay, N.B.
The contract for painting and glazing in connection with the school now being built has been let to C. W. Howe, Rosesay.

St. Catharines, Ont.
The general contract for the erection of a school on Queenston Street for the Trustees of School Section No. 6, Grantham, has been let to Ryan & Gardiner, Main Street E., Welland, at $10,514.

Toronto, Ont.
Work has been started on the erection of the Union Station for the Toronto Terminal Railway Company, 36 King Street E. General contractors, P. Lyall & Sons Construction Company, Montreal, and Front Street, Toronto. Superintendent of Construction, W. T. Griffiths. Engineer, J. R. W. Ambrose. Estimated cost, $3,000,000.

Business Buildings and Industrial Plants

Abbotsford, B.C.
The British Columbia Electric Railway Company, Limited, 425 Carrall St., Vancouver, have purchased a site for the erection of a telephone exchange building, and also contemplate an extension to the cable plant.

Adelaide Township, Ont.
S. Cates, Main Road, Arkona, Ont., is considering the erection of fireproof farm buildings to replace those destroyed by fire.

Austin, Man.
E. A. Stout is about to rebuild his machinery warehouse, and is in the market for corrugated iron, etc.

Blenheim, Ont.
The erection of a garage is being considered by E. W. Knight. Approximate cost, $5,000.

Brant Township, Ont.
Frank Hanmore, Concession 6, Walkerton, Ont., contemplates the erection of farm buildings, at an estimated cost of $3,000. Fireproof construction.

Brantford, Ont.
The Slingsby Manufacturing Company, Limited, are about to erect a storage warehouse at 266 West Mill Street. Sandlime and pressed brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,500. Secretary, John R. Varey.

Estevan, Sask.
The Canadian Northern Railway are building a station at Ninth Avenue and Fifth Street. Construction is superintended by F. Lake, Moose Jaw. Design is of the standard C. N. R. type.

Eureka, N.S.
The general contract for the erection of an extension to the mill of the Nova Scotia Underwear Company, Eureka, has been let to J. Cameron, New Glasgow, N.S. Approximate cost, $7,000.

Georgetown, Ont.
A by-law has been passed enabling the Glass Garden Builders, Limited, 201 Church Street, Toronto, to erect a factory for the manufacture of greenhouses.

Glen Oak, Ont.
Thomas Bairnes, Glenwood, Ont., is preparing plans for a large frame silo. Work will start shortly.

Hamilton, Ont.
Tenders on the construction of a garage are being received by W. Ellis, 76 Myrtle Avenue. Approximate cost, $4,000.

The Mercury Mills, Limited, 80 Park Street N., contemplate the erection of a knitting factory. The matter is being considered by the City Council.

Harwich Township, Ont.
Peter Hebblewaite, Blenheim, Ont., is considering the erection of farm buildings at an estimated cost of $3,500. Fireproof construction.

Kintail, Ont.
The erection of fireproof farm buildings is being considered by T. Griffin, Kintail. Estimated cost, $3,000.

Leamington, Ont.
Plans are being prepared for a marble works to be built for Cole Cullen. Concrete block construction, felt and gravel roofing.

Montreal, Que.
P. Papin, 688 Atwater Avenue, has commenced the erection of two stores and residences, estimated to cost $5,000. Work by day labor. Brick construction, concrete foundation, felt and gravel roofing.

Benoit & Fils, 184a Timothee Street, are about to make repairs to their factory, recently damaged by fire. Frame construction, felt and gravel roofing.

Mount Salem, Ont.
E. V. Learn is considering the erection of fireproof farm buildings to replace those recently destroyed by fire.

Nanaimo, B.C.
E. J. Bresemann, Royal Bank Building, has completed plans for a store to be built at Fitzwilliam and Selby Streets for F. J. Steward. Pressed brick construction, tar and gravel roofing. Approximate cost, $3,500.

Nelson, N.B.
The erection of a sawmill is being considered by Frasers Limited, Carlton St., Fredericton. Equipment will include a number of band saws. Approximate cost, $80,000.

Pembroke, Ont.
Work has been started on rebuilding the mill of the Hardwood Specialties Company, under supervision of J. A. Scott, Pembroke.

Petrolia, Ont.
The Canadian Oil Company are considering extensions and improvements to their plant. Manager, J. Tavenner.

Red Deer, Alta.
The erection of a warehouse is contemplated by Campbell Bros. & Wilson, Limited, Princess and Bannatyne Sts., Winnipeg, and Gaetz Avenue, Red Deer. The company are now negotiating for a site.

Sandwich West Township, Ont.
Seraphin Dupuis, Concession 6, Sandwich West Township, Lukerville, is considering the erection of fireproof farm buildings to cost about $3,000. Fireproof construction.

Toronto, Ont.
T. R. Morris, 150 Roxton Road, will let contracts for smaller trades in connection with the store and apartments in course of erection at Danforth and Langford Avenues.

Webster Heights, Sask.
McEwan, Webster & Moore, Leslie, Sask., propose to dismantle their creamery and re-erect it at Webster Heights.

Windsor, Ont.
Plans are being prepared for the remodelling of stores on Ouellette Avenue for W. T. Bartlet, Davis Building. Architect, J. C. Pennington, La Belle Building. Approximate cost, $5,000.

Tenders will be received until October 8th, by J. C. Pennington, Architect, La Belle Building, for remodelling a barber shop on Ouellette Avenue. Owner, W. G. Bartlet, Davis Building. Estimated cost, $3,000.

CONTRACTS AWARDED

Colborne, Ont.
The general contract for the erection of a store and residence on King Street for P. G. Ireland has been let to A. W. Teal. Frame and brick construction.

Cornwall, Ont.
The contract for heating and plumbing in connection with stores being erected on Pitt Street for R. Lalonde has been let to J. G. Hunter, 170 Pitt Street. Remainder of work will be done by general contractor.

Davidson, Sask.
Palmer & Galleymore are building a barn and residence for Luther Lick. Frame and concrete construction. Estimated cost, $4,500.

Ford City, Ont.
The contract for metallic window sash and frames for the addition to the Ford plant has been let to Henry Hope & Sons of Canada, Limited, Monaghan Road, Peterborough.

Halifax, N.S.
The following contracts have been let in connection with the business block in course of erection for F. R. Little, 120 Spring Garden Road:—painting, J. Ead, 83 Windsor Street; heating, Longard Bros., 213 Hollis Street; plumbing, Michael Day, 31 Compton Avenue; electrical work, Farquhar Bros., Barrington Street.

Levis, Que.
In connection with the freight shed being built for the Intercolonial Railway, the contract for painting and glazing has been let to the general contractor, J. B. Mitchell, Jacobs Building, Montreal, and the electrical work to Vincent & Say Electric Company, 25 Union Avenue, Montreal.

London, Ont.
Work is about to start on alterations to a store for L. Meredith, 466½ Talbot Street. The general contract has been let to J. Hayman & Sons, 432 Wellington Street. Approximate cost, $3,000.

Montreal, Que.
The contract for roofing the garage built on Ottawa Street for the Montreal Light, Heat & Power Company has been let to J. Dunphy, 55 Barrie Street, and for waterpaint sprinkling to Standard Spraying Company, 58 Victoria Square.

The following contracts have been let for the erection of a restaurant for the Windsor Arcade Company, Limited, 153 Peel Street:—masonry, J. Allan, 300 Atwater Avenue; carpentry, steel, roofing, plastering and painting, K. G. Rea, 59 Beaver Hall Hill; heating, J. A. Gordon, 301 St. Antoine Street; plumbing, Hickey & Aubut, 93 Dominion Street.

Ottawa, Ont.
In connection with the addition to a warehouse on Slater Street for the Bate Realty Company, the contract for steelwork has been let to the Dominion Bridge Company, Carlton Chambers. Heating, plumbing and electrical work not yet awarded.

The Ottawa Dairy Company, Cooper Street, have let the general contract for the erection of an ice making plant to K. W. Shantz, c/o Wegnier Machine Company, Perry & Mississippi Streets, Buffalo, N. Y. Estimated cost, $15,000

Port Arthur, Ont.
The contract for roofing at the elevator built at Third Avenue and King Street for the National Elevator Company, Limited, has been let to Wells & Emerson, Cumberland Street S., and the painting to the general contractors, Barnett & McQueen, Christina Street, Fort William.

Quebec, Que.
The contract for steelwork at the shed

being built for Germaine Lepine, 281 St. Valier Street, has been let to the Eastern Canada Steel & Iron Works, Limited, 76 Peter Street, and the roofing to N. Barbeau, 36 Bridge Street. Remainder of work by general contractor.

St. John, N.B.
The contract for heating and plumbing at the business premises erected for the J. Kennedy Estate has been let to F. S. Walker, 18 Germain Street.

Toronto, Ont.
In connection with the theatorium to be built at 75-77 Queen Street E. for Major Boyce Thompson, 143 Crescent Road, the contract for steelwork has been let to Hepburn & Disher, Limited, 18 Van Horne Street. Approximate cost, $6,000.

Vancouver, B.C.
In connection with the premises being built at Main and Pender Streets for the Canadian Bank of Commerce, the contract for marble tile, marble base and hardware has been let to W. N. O'Neil Company, Limited, 550 Seymour Street.

Windsor, Ont.
The general contract for remodelling a store on Sandwich Street for Zakoor Bros. has been let to George Haugh, 117 Church Street. Approximate cost, $3,000.

Residences

Halifax, N. S.
The City Building & Land Company, 164 Hollis Street, are about to build two residences on Cedar Street at an approximate cost of $5,600. Frame construction, concrete foundation, shingle roofing.

Leamington, Ont.
George Bullock, Victoria Street, has commenced the erection of a residence estimated to cost $3,200. White brick construction, concrete foundation, shingle roofing.

Montreal, Que.
R. Brodeur, 2875 Chateaubriand Street, has commenced the erection of two flats, estimated to cost $3,000. Plastering and plumbing will be let.

A residence is being built on Wolseley Street by John Dominique, Marcil Ave. Brick veneer constrdction, slate roofing. Approximate cost, $4,000.

J. Girard, 46 Joseph Boulevard W., has commenced the erection of flats on Ville Marie Street, estimated to cost $7,000. Tenders on all trades are being received by owner.

Nixon, Ont.
The erection of a frame and brick residence has been started by Fred Lucas, Nixon. Estimated cost, $3,000.

Ottawa, Ont.
E. Bellanger, 26 St. Francis Street, is considering the erection of a residence at an estimated cost $3,800. Double brick veneer construction, shingle roofing.

H. P. Beck 126 Parks Street, is considering the erection of a residence to cost $6,000. Double brick veneer construction, stone foundation, shingle roofing.

W. G. Wilson, 1083 Wellington Street, has commenced the erection of a residence on Bethany Road, estimated to cost $4,000. Brick veneer construction, stone foundation, shingle roofing.

Poole, Ont.
John Fetter, Poole, Millbank, Ont., is preparing plans for a residence. White brick construction, shingle roofing. Estimated cost, $3,000.

Quebec, Que.
Work has been started by Ernest Rochette, 40 Des Stigmates Street, on the erection of a residence on Bourlamarque Street. Brick construction, concrete foundation, metal roofing. Approximate cost, $6,000.

Lavoie & Frere, 56 Jeanne d'Arc St., are building a residence on Cartier Ave. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $6,000.

Work on the erection of a residence on Aberdeen Street has been started by East & Masson, 62 Nazaire Street. Brick construction, metal roofing, concrete foundation. Estimated cost, $8,000.

St. Jacobs, Ont.
Plans of a residence estimated to cost $3,500 are being prepared by Anthony Gies, Clearview Farm, St. Jacobs.

Three Rivers, Que.
C. E. Hamelin, 31 Niverville Street, is about to erect a residence at an approximate cost of $3,500. Brick construction.

Toronto, Ont.
L. Battershill, 119 Vaughan Road, has commenced the erection of a pair of residences at 88-90 Auburn Avenue. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $3,800.

W. H. Maton, 1723 Dufferin Street, has commenced the erection of a duplex residence at 28 Ravensden Avenue. Smaller trades will be let. Brick construction, tar and gravel roofing. Estimated cost, $7,000.

Tenders on painting, wiring, plumbing and heating required at the residence at 278 Runnymede Road are being received by A. Poyntz, 426 Queen Street W. Particulars at job.

H. Lefneski, 423 Roxton Road, has commenced the erection of a residence, estimated to cost $4,500. Smaller trades will be let. Brick construction, shingle roofing.

Sykes & Hurst, 1248 St. Clair Avenue, have commenced the erection of a residence at 15 Lauder Avenue, estimated to cost $4,500. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started on the erection of a residence at 199 Neville Park Boulevard by H. E. Graham, 2469 Queen Street E. Some of smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $3,000.

G. T. Death, 244 Sheldrake Ave., has commenced the erection of a residence at 82 Glencairn Avenue, estimated to cost $5,000. Smaller trades will be let. Brick construction.

J. W. Butchart, 1 St. Ives Avenue, is building two residences on St. Leonards Avenue, estimated to cost $12,000. Smaller trades will be let. Brick construction.

Lankin Bros., 43 Harcourt Avenue, have commenced the erection of a pair of residences, estimated to cost $4,400. Brick construction, shingle roofing. Smaller trades will be let.

Windsor, Ont.
Work has been started by Peter Osterhout, Manning Block, on the erection of a residence on Gladstone Street. Frame and brick construction, concrete foundation, shingle roofing. Approximate cost, $3,800.

Tenders on the erection of flats on Howard Street for David Meretsky, 120 Aylmer Avenue, will be received until October 16th. Architects, G. Jacques & Company, Boug Block. Frame construction, concrete block foundation. Approximate cost, $5,000.

CONTRACTS AWARDED

Dover Township, Ont.
The general and masonry contracts for the erection of a residence for Thomas Burke, Bear Line, Ont., have been let to Isaac Moore, 19 Wilson Ave., Chatham, and the carpentry to Glen & Howe, c/o general contractor. Estimated cost, $3,000.

London, Ont.
The contract for electrical work at the apartments built on Williams Street for W. D. Thomas, 531 Dundas Street, has been let to the People's Electric Company, 641 Dundas Street.

Montreal, Que.
The general contract for the erection of a residence on Roslyn Avenue for S. W. Shier, 28 Vallee Street, has been let to Louis Beaudry, 2420 Hutchison St. Brick construction, slate, felt and gravel roofing. Estimated cost, $5,500.

Work has been started by Valin & Bail, 2 Lamoriciere Street, on the erection of a residence on Durocher Street for Victor Guertin, 31 Sherbrooke Street W. Sub-tenders on all trades are now being received by the general contractors. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $7,000.

Montreal, West, Que.
The general contractors for the residences now in course of erection on Parkside for W. H. Reid, 442 Prince Albert Street, Westmount, are White Realty & Construction Company, Ltd., 306 Coronation Building. Approximate cost, $7,000.

Nanaimo, B. C.
The general contract for the erection of a residence for E. Kermode has been let to Chester Young. Work will start at once. Estimated cost, $3,000.

Neustadt, Ont.
Jacob Hahn, Hanover, Ont., has been awarded the contract for the erection of a residence for W. Heuther, Neustadt. Milton pressed brick construction, shingle roofing. Approximate cost, $5,000.

Ottawa, Ont.
In connection with the residence being built on Belmont Street by B. A. Grison, 89 Fentiman Street, the contract for electrical work has been awarded to H. L. Allen, 377 Somerset Street, and the plumbing to J. B. Bland, Bank Street.

The following contracts have been let in connection with the residence being built on Creighton Street by Samuel Brooks, 62 Union Street:—carpentry, J. Meyer, 182 St. Patrick Street; roofing, J. Welch, 141 Waverley Street; painting, S. Kelley, 191 McKay Street; heating, Ottawa Plumbing Company, 844 Somerset Street; plumbing, Charles Wyman, 249 Creighton Street; electrical work, C. C. Gould, 219 Florence Street.

Quebec, Que.
The roofing contract in connection with the residence being built on Bourlamarque Street by Arthur Frenchette,

260 St. Cyrille Street, has been let to E. Falardeau, 143 Dorchester Street, the painting to Pelchat & Aubin, 182 Bayard Street, and the heating, plumbing and electrical work to Louis Frenchette, c/o owner.

In connection with the residence being built on Scott Street for R. Genest, 40 Cote St. Genevieve, the contract for roofing, heating, plumbing and electrical work has been let to J. LaFrance, 21 Plessis Street, the plastering to E. Belanger, 185 St. Marguerite Street, and painting to Pelchat & Aubin, 182 Bayard Street.

The general contract for the erection of a residence for Jules Gingras, 203 St. Oliver Street, has been awarded to A. Darveau, 152 Latourelle Street. Brick construction, concrete foundation, metal roofing. Estimated cost, $7,000.

Work has been started by J. Salvard, 218 Richelieu Street, on the erection of a residence for J. A. Choquette, 106 Grande Allee. Brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $5,000.

Work has been started on the erection of a residence on Park Avenue for William Campbell, 86 Maple Avenue. General contractor, Alexander Fackney, 107 St. Joachim Street. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $7,000.

Sarnia, Ont.

John Ellinor, 128 Victoria Street, has commenced the erection of a residence for Thomas Quinn, 118 College Avenue S. The masonry contract has been let to J. Park, 109 South Mitton Street. Brick construction, concrete foundation. Estimated cost, $3,000.

Toronto, Ont.

The following contracts have been let in connection with the residence built at 25 Cranborne Crescent for Thomas Mix, c/o G. M. West, 2 College Street;—plumbing and heating, McNaughton & McKenzie, 1029 Shaw Street; plastering, J. Robertson, 615 Lansdowne Avenue; painting, R. Morse, 186 Avenue Road; tinsmithing, W. C. Gurney, 4 Spruce St.

Walter Simpson, 175 Hillsdale Avenue, has commenced the erection of a residence for Robert Johnston, Manor Road. Smaller trades will be sub-let. Brick construction, shingle roofing. Approximate cost, $3,000.

In connection with the residence being built at 106 Oakwood Avenue for W. E. Link, 60 Macpherson Avenue, the contract for plumbing and heating has been let to J. E. Fullerton, 89 Concord Ave., and the plastering to H. Hill, 16 Lawlor Avenue.

The contract for plumbing and heating in connection with the residence in course of erection at 84 Glencairn Ave. for J. MacDonald, 536 Bathurst Street, has been let to A. A. Earl, 774 Gladstone Avenue, and the plastering contract to Clark Bros., 203 Bedford Park Avenue.

Power Plants, Electricity and Telephones

Blyth, Ont.

C. H. Beese, Blyth, is in the market for one dynamo, 15 to 25 light, direct current, 110 volt and one volt meter.

Brigden, Ont.

The by-law to provide for the purchase of electrical equipment has been defeated.

Chesley, Ont.

A by-law has been carried providing for the installation of Hydro Electric power and lighting systems. Town Clerk, H. S. Sanderson.

Dryden, Ont.

The Town Council are considering the installation of a telephone system estimated to cost $5,000. A by-law will be prepared. Clerk, Ira J. Wilde.

Galt, Ont.

The installation of an ornamental lighting system is being considered by the Town Council. Clerk, Joseph McCartney. Estimated cost, $6,860.

Hensall, Ont.

The Town Council are considering the installation of Hydro Electric power and lighting systems, and will secure plans and estimates. Clerk, Alexander Murdock.

Wallaceburg, Ont.

Work is about to start on the construction of a four mile transmission line under the supervision of the local Hydro Commission. Tenders will be called for material, including poles, cross arms and No. 6 bore copper wire. Town Engineer, W. R. Wayborne.

CONTRACTS AWARDED

Ottawa, Ont.

The City Council have let the contract for the supply of underground cable to the Eugene Philips Company, De Gaspe Avenue, Montreal.

Saskatchewan Province

The contract for the construction of the Gladstone Rural Telephone Company's system has been awarded to J. E. McNaughton, Bethune. Contractor is in the market for about 770 poles, 34 miles of circuit, 27 phones, 195 six-pin cross arms and 35 ten-pin cross arms. Approximate cost of work, $4,355.

Fires

Amherst, N. S.

Fire has entirely destroyed the residence of Mrs. Benjamin Harrison, Academy Street.

Athens, Ont.

Fire has destroyed the barns belonging to Abraham Berney, Sheldons Corners.

Aultsville, Ont.

The residence of Cory Hallister has been totally destroyed by fire.

Banff, Alta.

The hotel on Banff Avenue owned by Dr. Brett has been totally destroyed by fire. Loss, $50,000.

Charlottetown, P. E. I.

Fire has destroyed a warehouse belonging to J. A. Farquharson & Company, Dorchester Street. Loss, $5,000, partially covered by insurance.

Hobbema, Alta.

Fire has destroyed a barn belonging to the Department of Indian Affairs, Ottawa. Superintendent, Duncan C. Scott, Ottawa. Loss, $4,000.

Kent Bridge, Ont.

A barn owned by John Lewis has been completely destroyed by fire. Loss, $5,000.

Martinville, Que.

The residence of Albert Gagnon has been gutted by fire. Loss unknown.

Montreal, Que.

The sash and door factory of Benoit & Fils, 190 Amherst Street, has been destroyed by fire. Loss, $50,000.

The cabinet shop of O. H. Randal Company, Ltd., 1328 City Hall Avenue, has been destroyed by fire. Loss, $10,000.

North Wakefield, Que.

Fire has destroyed the Post Office owned by Mrs. C. Pritchard. Loss, $8,000, partially covered by insurance.

Pakenham, Ont.

The mill, elevator and offices of the Renfrew Flour Mills Company, Regina Street, have been entirely destroyed by fire. Loss not yet known, but partly insured.

Miscellaneous

London, Ont.

The City Council are considering the purchase of a motor street flusher at an approximate cost of $7,000. Clerk, Samuel Baker.

London Township, Ont.

R. G. Fisher, care of Meredith & Fisher, Dundas Street, will probably be in the market shortly for oil and gas drilling equipment.

New Westminster, B.C.

Tenders on the installation of an electric freight elevator will be received until 4 p.m., October 29th, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa. Plans, etc., with the Caretaker, Public Building, New Westminster, William Henderson, Resident Architect, Victoria, at the Post Office, Vancouver, and the Department, Ottawa. Specifications at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Owen Sound.

The Town Council contemplate the purchase of a fire truck. Fire Chief, J. Thompson.

Victoria, B. C.

Plans are being prepared for salt water baths to be constructed on Douglas Street for the Victoria & Island Development Association, Board of Trade Building. Architect, Jesse M. Warren, 503 Central Building. Approximate cost, $75,000.

Winnipeg, Man.

Engineer W. P. Brereton, 223 James Avenue, has submitted a report to the Board of Control, estimating the cost of the installation of a gas distributing system at $2,500,000, including services and meters.

CONTRACTS AWARDED

Toronto, Ont.

The Turbine Equipment Company, Ltd., C. P. R. Building, Toronto, have been awarded the following contracts for the supply of machinery:—Canadian Copper Company, Copper Cliff, Ont., two De Laval centrifugal pumps, capacity 7½ million gallons each per day, direct connected to Canadian Westinghouse motors; Pilkington Bros., Thorold, one De Laval three stage pump, direct connected to Canadian Crocker Wheeler motor; Samuel Austin & Company, Thorold, one De Laval single stage pump, direct connected to Canadian Crocker Wheeler motor; Kerr Lake Mining Company, Cobalt, one De Laval three stage pump, direct connected to Canadian Westinghouse Company motor. Manager, R. N. Austin.

Tenders and For Sale Department

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, October 15th, 1915

for

New School Building, Park School

between

Sydenham St. and St. David's Street

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by Surety Companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINSON,
Secretary-Treasurer.

MILES VOKES,
Chairman of Committee.

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Department of the Naval Service

Tenders for Miscellaneous Material

Sealed tenders, addressed to the Undersigned, will be received up to noon on **Tuesday, October the 19th**, for the undermentioned items for delivery to H. M. C. Dockyards at Halifax, N. S., and Esquimalt, B. C.

Brass Bars
Brass Sheets
Brass Tubes
Copper Sheet
Copper Tubes
Zinc Plates
Lead, milled or sheet
Antimony
Aluminum
Steel Angles
Steel Boltstaves
Steel Plates
Steel Sheets
Steel for Tools
Iron Firebar
Iron, pig
Iron angles
Iron Boltstaves
Iron Sheets
India Rubber Sheet packing, etc.

Forms of tender and all information may be obtained by application to the Undersigned or to the Naval Store Officer at H.M.C. Dockyard, Halifax, N.S., or Esquimalt, B.C.

Applicants for forms are requested to state definitely the item or items on which they desire to tender.

G. J. DESBARATS,
Deputy Minister of the Naval Service.

Department of the Naval Service,
Ottawa, September 11th, 1915.

Unauthorized publication of this advertisement will not be paid for.—85276. F

Concrete Machinery For Sale

Three Concrete Mixers, twelve Concrete Hand Dump Carts, two "Beatty" Hoists for sale at sacrifice price. Apply F. C. Creed, 903 Read Building, Montreal. 40-41

Late News Items

Daysland, Alta.
The Burrard Grain Company have let the contract for the erection of an elevator to F. W. McDougall, 321 Eighth Avenue, Calgary. Frame construction, concrete foundation. Estimated cost, $6,000.

Hamilton, Ont.
The following contracts have been let in connection with the addition now being built at the factory of the National Paper Goods Company, Queen Street W.:—roofing, T. Irwin & Son, 22 McNab Street S.; painting, J. Almand, 173 Walnut Street S.; plumbing, A. Clayton, 1080 Cannon Street E.; elevator, Otis-Fensom Elevator Company, Ltd., Victoria Avenue N. Heating and electrical work by owners.

Humboldt, Sask.
Tenders on the construction of a concrete pump well will be received until 5 p.m., October 11th, by the Town Secretary, W. H. Stiles. Plans and specifications at office of the Resident Engineer, J. T. Gordon. Consulting Engineers, Chipman & Power, Main Building, Toronto.

London, Ont.
E. Leonard & Sons, York Street, are considering the installation of a quantity of electrical equipment, including motors for operating lathes, planers, etc.

Mount Brydges, Ont.
Work has been started by W. H. Longfield on the erection of a factory for the Crow Auto Company. Concrete block and white brick construction. Approximate cost, $10,000. Manager of the Company, R. E. Allen.

Ottawa, Ont.
The general contract for the erection of an ice making plant for the Ottawa Dairy Company, Cooper Street, has been let to Alexander Garvock, 136 Lewis Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $15,000.

Peterborough, Ont.
The following contracts have been let for alterations and additions to apartments on Water Street for W. H. Hill, Crown Building:—general, masonry, carpentry, roofing, plastering and painting, Ephgrave & Barrett, 615 Union Street; heating and plumbing, R. G. Sturgeon & Company, 202 Charlotte Street; electrical work, Alexander & Miller, 438 George Street. White brick construction, concrete foundation, asbestos roofing. Estimated cost, $5,000.

Toronto, Ont.
The Board of Control will receive tenders until October 12th for asphalt, bitulithic, concrete, rocmac and brick block paving, concrete curbings and sidewalks on a number of streets. Plans and specifications at office of the Works Department, City Hall.

Winnipeg, Man.
P. S. Wright, 12 Harrow Apartments, has commenced the erection of a residence on Oxford Street S., estimated to cost $10,000. The contract for plastering has been let to Malcolm & Purvis, 400 Bannatyne Street, the painting to G. Drewry, c/o owner, and heating and plumbing to Rendall & Bell, Portage Avenue. Brick construction, stone foundation, shingle roofing.

Fires

Kincardine, Ont.
William Mitchell's store has been badly damaged by fire. Loss covered by insurance.

Manvers Station, Ont.
Fire has entirely destroyed the brick residence, barn, stables and driving shed owned by H. Sandy. Loss not yet known.

Portage, Ont.
A barn belonging to Henry Ennest has been totally destroyed by fire. No insurance.

Rondeau, Ont.
Two barns, the property of Petes Hebblewaite, have been destroyed by fire. Loss, $6,000.

Scotland, Ont.
The barn, warehouse and garage belonging to the Scotland Hotel have been destroyed by fire. Loss, $4,500, with small insurance.

Smith Falls, Ont.
Fire has destroyed the barns and other outbuildings belonging to Charles Pattimore. Loss unknown.

St. Angele De Laval, Que.
Fire has destroyed the following properties, causing a total loss of $20,000:—I. Coulombie, general store, Paul Bourgeois, residence, I. Doucet, residence. Owners will rebuild. Stone and brick construction.

St. John, N. B.
The following property has been destroyed by fire:—residence, Miss S. Drummond; residence, George West; residence, Mrs. L. M. Carr; residence and barn, Mrs. S. Drummond; store, Robert Smith. Total loss about $12,000, partially covered by insurance.

Watford, Ont.
The barns of Charles Coates have been totally destroyed by fire. Loss covered by insurance.

Winnipeg, Man.
Fire has destroyed the stores and offices owned by A. H. Pulford, 16 uskin Row. Loss, $10,000.

Yarmouth, N. S.
Fire has totally destroyed the residence of Robert J. Melvin, Apple Tree Hill. Loss is partly insured.

ESTABLISHED 1886

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Constructional Operations in the Winter Season

CAN we increase the volume of engineering and building construction in winter? This question, which was propounded in our issue of September 15, is suggestive of a discussion which should mean much to the constructional interests in this country. It has been pointed out that except in the most severe climate constructional work in Canada is not prohibited for a season of three or four months, and that there are not many days when the weather makes building and engineering operations impossible. There are sound arguments in favor of prolonging the constructional season, and where possible of carrying operations right through. There is an altogether too prevalent disposition to "close down for the season." Certain it is that in the winter labor is more plentiful than in the summer; certain it is that the contractor would rather be working than killing time; certain it is that capital and plant are more profitable when producing than when lying idle.

Much has been written about the conduct of constructional operations in winter, but nothing has yet been presented in the way of a sum total of experience, and this The Contract Record will endeavor to present in forthcoming issues. Isolated articles relating to devices employed upon individual contracts, methods of concreting in cold weather, and heating concrete aggregates, are interesting as far as they go, but a collection of evidence entered in the form of a symposium, to which ready reference can be had, cannot fail to be far more valuable—to say nothing of exerting an influence favorable to continued activity.

It will be interesting—and suggestive, perhaps,—to consider a few recent developments.

A valuable contribution to the available data on methods of concreting in freezing weather, and the effect of frost upon concrete, was contained in a paper by Mr. J. Hammersley-Heenan, of Montreal, abstracted in our issue of September 30, 1914. In this article it was pointed out that as a result of the experience of the last few years it might be said that the freezing of concrete would not damage it if it first had an opportunity to set under favorable conditions for about two days—that the effect of the freezing was simply to delay the process of hardening, which would again proceed under suitable conditions and eventually attain its full strength—and that the damage was caused by alternate freezing and thawing during the process of setting.

Protective Measures Employed

The methods employed in protecting work carried out in the winter are varied, and worthy of investigation. In the case of concrete in mass of large bulk it is not considered necessary to apply external heat, as the large body of concrete will generate sufficient heat during the process of hardening to enable the mass to set. It is sufficient to protect the outside of the concrete and keep the heat in by covering the concrete with clean straw. For light sections of concrete poured at a temperature not below 22 deg. F. some engineers allow salt to be used in a proportion not exceeding ten per cent., while others recommend heating the water, using coke or wood fires, and in the case of lower temperatures heating the ingredients by means of steam coils or radiators.

Of many interesting and enterprising instances of prosecuting building operations in the winter we recall the case of where a large warehouse in the United States was erected under the cover of a huge tarpaulin, beneath which a uniform heat was maintained throughout. The reconstruction of the Edison Company's concrete buildings was carried out last winter principally by maintaining fires inside the buildings so as to aid the setting of the concrete. On engineering work one might cite the building of the substructure of the G. T. P. bridge over the Fraser River at Prince George, detailed in our issue of April 28 last. On this work the concrete was prevented from freezing by heating the gravel by means of steam boxes. The forms were covered by tarpaulins, under which fires were maintained, or steam heat was furnished from radiators built on the work. The heating was continued for from three to seven days after the placing of the last concrete. **Concrete was actually placed at a temperature of 35 deg. below zero, while a temperature of fifty below was experienced while the concrete was setting.**

Yet another instance is afforded by operations carried out at Halifax some time ago by Mr. John Kennedy, M. Inst. C. E. Here the concrete was alternately wetted and frozen, and the method of protection adopted was to cover the concrete piles with wood about two inches thick.

The Consideration of Cost

As to the cost of winter work, Mr. L. C. Wason, President of the Aberthaw Construction Company, of Boston—a firm which puts through a number of good-sized jobs every winter—tells us that the expense of protection against the weather in the case of concrete work is not more than six to ten per cent. additional. Part of this may be charged to the heating operations, part to the decreased efficiency of the workmen, and a smaller part to the comparatively slow progress of work due to allowing a longer period for the concrete to harden. "In spite of these adverse factors," writes Mr. Wason, "each year we have found several owners who have considered it worth while to pay a little extra on the score of certain and early delivery of completed buildings on the first of the new year."

It has been said that where there's a will there's a way. This holds good in the majority of cases. Certainly many enterprising engineers and contractors have proved that there are ways of carrying out winter work profitably and satisfactorily. So far, the greatest enterprise seems to have come from the United States. This is not as it should be, for the question is a far more urgent one in a country like Canada, with its more northerly latitude. We have to cope with more severe conditions, and for that reason it is worth while making the study of winter construction an exact science.

It is hoped that the publication of this article will induce a lively and earnest discussion of the subject, with a view to showing the constructional community and the public at large that in the engineering of building and general constructional work, as in other branches, things that were deemed impossible a decade ago are possible, practicable, and even economical, today.

Rebuilding Belgium

IN a discussion of the conditions attendant upon the rebuilding of Belgium—when the time comes—an English authority offers a few pointers to British industrial firms. After the war, we are told, Belgian contractors will require large quantities of materials, as well as much credit, and Belgium will be seeking for the capital necessary to reinstate the country. Before the war the Germans held a predominant position in the Belgian building industry. They had made a close study of what was required and of the lines supplied by their competitors, and they were able to secure the bulk of Belgium's import trade by means of low prices, prompt delivery, and a system of payment by instalment. British manufacturers desirous of supplanting the Germans in the Belgian market must not rely upon the quality and appearance of their products, but must meet German competition on its own basis, and make their goods exactly in conformity with Belgian official requirements. Unless British firms are prepared to compete with the Germans, then, in spite of the ruin of the war, the Empire's enemy will again get a footing in Belgium.

The Activated Sludge Process

IN a discussion on sewage treatment at the International Engineering Congress last month, Mr. George W. Fuller, of New York, commented on the activated sludge plan as sound in theory and very promising, in that clarified liquid and non-putrescible sludge is produced. On the other hand questions of power and attendance might make it uneconomical. He emphasized the need for experienced management of sewage treatment plants as absolutely essential to satisfactory operation. In sewer construction the engineer should make provision, he thought, for proper inspection of house connections to insure tight pipe joints. He cited the case of a large sewer construction job in which 2 per cent. of the total cost was allotted to rigid inspection of joints in the mains, but later on, when the house connections were made, there was no adequate joint inspection and the resultant storm-water leakage into the laterals flooded the sewage treatment plant. Mr. Fuller said he had abandoned mortar joints and has substituted bituminous compounds to secure tighter sewers.

The Rogers Pass Tunnel

FOLLOWING the presentation of a paper on Tunnels at the International Engineering Congress at San Francisco last month, Mr. J. G. Sullivan, of the Canadian Pacific Railway, emphasized the reasons for using the pioneer drift in driving the five-mile Rogers Pass tunnel. With this scheme it has been possible to keep men at work drilling, mucking and loading except where shooting is actually in progress. As a result the contractors have broken the American record in tunnel driving. Whereas the original offers of contractors for driving the tunnel called for completion in seven years, the bore will actually be finished in three and one-half years, half of this time being taken in the approaches. He emphasized that the scheme was applicable only in hard rock.

Competition is said to be when a pair of chronic dyspeptics get down to comparing symptoms.

LETTERS

Carpeting Macadamized Roads with Bituminous Material

Editor, The Contract Record:

In my opinion, the principle set forth by Mr. J. W. B. Blackman, City Engineer of New Westminster, in your issue of September 29, is correct.

I have personally followed this idea in several instances and would prefer it to destroying the old macadam road, which has already found its set and is compacted equally as well or better than would be the case in new construction. The idea has further been carried out in the Repair Department of this city. By an extension of the city limits a few years ago the city inherited several macadamized country roads. We have not pursued the policy of destroying these roads but of improving them—in some instances by simply cleaning and placing thereon from two to three inches of bituminized surfacing, the depth depending upon the necessary amount to bring the roadway to an even surface; in other instances the road has been cleaned and scarified and brought to an even surface with the old material, but without disturbing the solidity of it lower than the depth to which the scarifying penetrates. A bituminous surface is then placed over this, it first being rolled and the finished surface placed about 2½ inches in depth.

Yours very truly,
CURTIS HILL,
(City Engineer, Kansas City, Mo.)
Kansas City, Mo., Oct 4th, 1915.

* * *

Perfectly Good Practice

Editor, The Contract Record:

In my opinion, the practice of laying bitulithic pavement on an old macadam road is a perfectly good one. Nearly one hundred miles of asphalt surface, laid under what is known as the Topeka specification, was constructed on old macadam roads two or three years ago in the Borough of Queens, New York City, and it has given excellent satisfaction.

Yours truly,
GEORGE W. TILLSON,
(Consulting Engineer to the Borough of Brooklyn.)
Brooklyn, Oct. 1, 1915.

* * *

European Experience Prior to the War

Editor, The Contract Record:

The point raised by Mr. Blackman in connection with the carpeting of macadamized road surfaces, while comparatively a new subject in Canada, has been receiving for some time the serious consideration of road builders in Europe. As an indication of how seriously this matter was being considered, it may be of interest to state that just previous to the commencement of hostilities in France, Col. R. E. Crompton, Consulting Engineer of the British Road Board, was asked by the French Government to consult with and advise with their Department of Roads and Bridges as to the best methods of repairing the extensive system of macadamized roads throughout France. One of the principal methods considered was the placing of a bituminous carpet upon the macadamized road surface, after previously getting it into suitable condition.

In my opinion there is nothing to equal a good concrete base, for if properly constructed this will withstand severe traffic conditions; yet there are many macadamized roads that are not sufficiently destroyed to take a carpet of bituminous material, which will lengthen the ultimate life of the road considerably. The concensus of opinion among French road engineers is that where motor traffic combined with heavy vehicular traffic exists as it does on many of the French roads, a fairly heavy bituminous carpet lengthens the life of the road materially. The selection of the type of bituminous carpet to be used is one that should receive careful consideration before proceeding with any extensive programme of road construction.

The subject raised by Mr. Blackman is one that should receive serious attention from all interested in the development of good roads.

Yours truly,
LUCIUS E. ALLEN.
Belleville, Ont., Sept. 29, 1915.

* * *

Civil Engineering a More Dignified Profession if a Closed One

Editor, The Contract Record:

Your recent editorial, and the letter of Professor C. R. Young regarding the licensing of civil engineers and the new law of the State of Illinois, have touched upon a subject which should be of interest to every practising engineer in Canada.

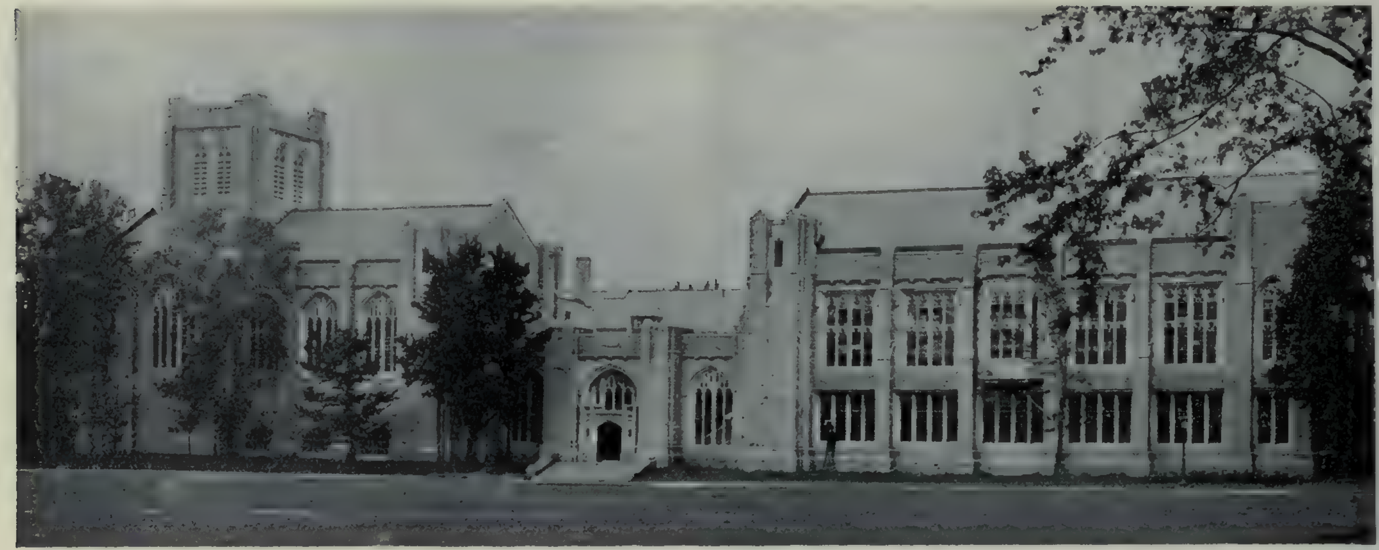
Many arguments can be offered in support of the present situation with respect to the profession of civil engineering in this country. But in the writer's opinion, more valid reasons can be advanced to show that it would be desirable to convert it into a closed profession. A discussion of the case was heard in Canada some years ago, and if there is any hope that the engineers of the country have experienced a change of heart, it would be highly desirable to re-open the question.

Law and medicine are the two most prominent examples of closed professions. What would any lawyer or doctor of the country think if it were seriously proposed to take away his privileges in this regard? What would the public think. All other arguments aside, the closing of these professions has been, and is, of benefit. Because of these privileges the public hold them in higher esteem, and very properly so. While the passing of examinations is not a final test of ability, it is the best available to meet practical conditions. The restrictions with which closed professions are hedged, may exclude some very desirable and competent men, but the far greater effect is to exclude a larger number of incompetents.

These advantages would be equally true in the case of civil engineering. To convert it into a closed profession would give it an added dignity and would tend to higher scientific qualifications, from all of which the public would derive a benefit.

State and Provincial licenses are too narrow. A National law is desirable, with international affiliations. Some temporary inconvenience would be met, and concessions would no doubt have to be made in order that hardship would not be created. The full benefit might not be realized by the present generation. But because the ideal cannot at once be reached is not a sufficient reason why nothing should be done.

Yours truly,
W. A. McLEAN,
(Chief Engineer of Highways for the Province of Ontario.)
Toronto, Oct. 1, 1915.



Knox College, Toronto, upon completion.

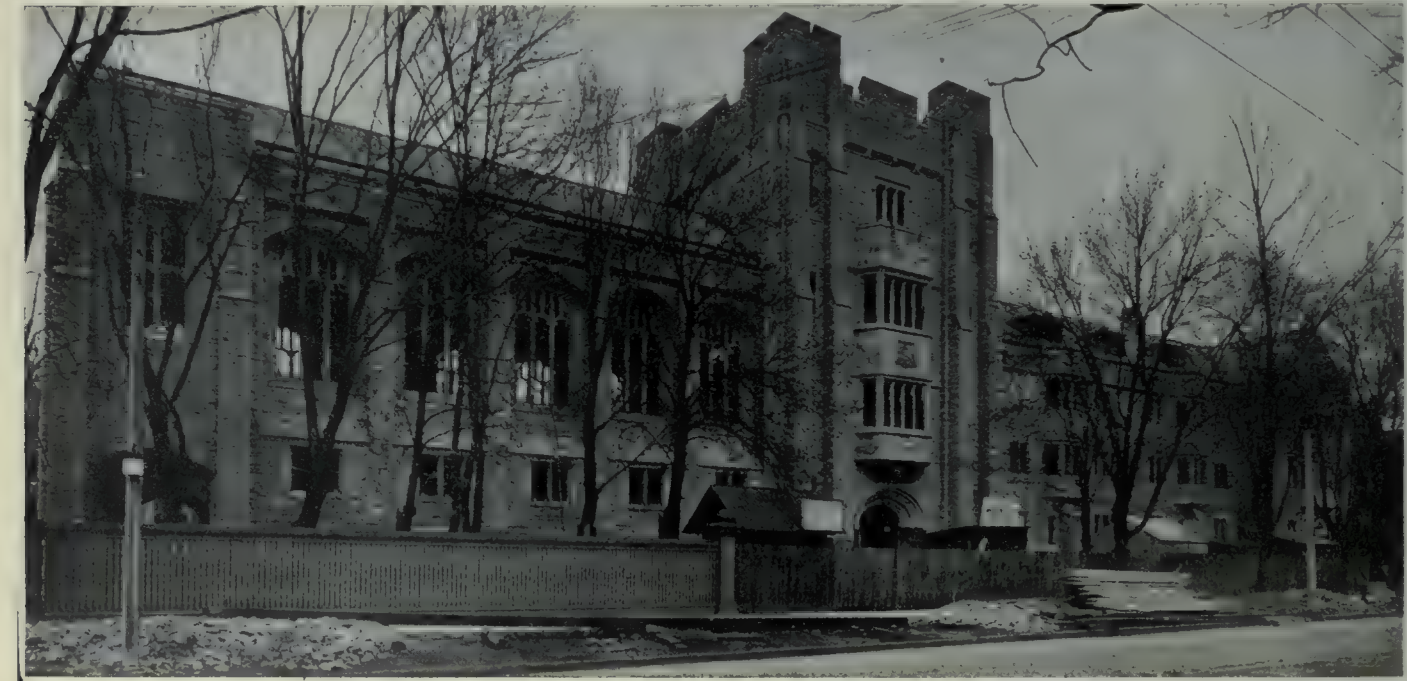
The New Knox College, Toronto

Formal Opening of Fine New Buildings Erected at a Cost of More Than Half a Million Dollars

THE new Knox College at Toronto, the formal opening of which took place recently, ranks amongst the foremost examples of Collegiate Gothic architecture on the continent. The plan adopted divides the building into two distinct groups—one comprising the academic rooms, library, and chapel, and the other the dormitories, living room, and dining hall. The academic portion of the building is 285 feet long from north to south, nearly filling the west side of the University lawn, which at present is bounded on the north by the old University College, on the east by the University library, and on the south by the open approach and the Convocation Hall. The residential portion of the building extends along St. George Street a distance of 224 feet. The space between these two buildings forms a quadrangle about 100 feet wide by about 200 feet long.

A cloister one storey high traverses the quadrangle. The building facing the University lawn is practically divided into two. On the south is the chapel, and on the north is the library, with the lecture rooms below. The central part is devoted to the entrance hall.

The collegiate style of Gothic architecture has been chosen because it lends itself to more modern academic lighting requirements. This style has been given a heavy massive character to harmonize more



Knox College under construction. The St. George Street elevation.

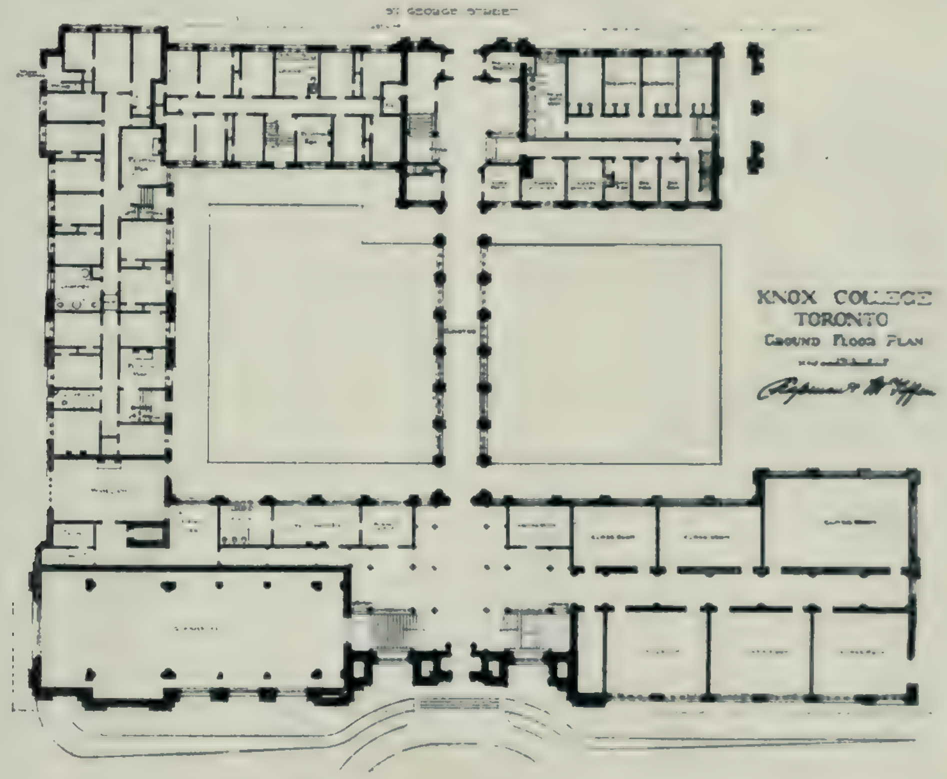
with the University College Building, and also to give a suggestiveness of the traditional massive Scottish architecture.

The general building material throughout the exterior is Credit Valley stone, trimmed with Indiana limestone, the roof being covered with unfading green slate. Metal casements with leaded glass have been used throughout. The construction of the building is of steel frame, reinforced concrete slab and tile partitions. The building is thus fireproof, with the exception of the open timber roof construction over the chapel, dining hall, and library. Terrazzo floors are used in the entrances and corridors, quarry tile in the dining hall and chapel, and Tennessee marble for the treads and risers of stairs in the main entrance. The interior walls of the chapel and entrance halls are built up with art stone cast on the premises. This has also been used for trimming the large windows in the library and dining hall. Mechanical ventilation is used in connection with the heating plant, which is connected with the central University heating plant.

The uniform coloring and accurate method of bonding the stonework throughout are particularly in evidence, and indicate clearly the persistent aim of the masonry contractors, Messrs. H. N. Dancy & Son, Limited, to produce the highest standard of workmanship. One of the notable features in the construction work is the amount of leaded glass used in the building. The N. T. Lyon Glass Company, of Toronto, who were the sole contractors for all the glass in the entire college, state that it contains more leaded glass than any other building in the country, and that it is also the first building in which they have introduced the celebrated Norman slabs.

The contractors employed on the work were as follows: masonry, H. N. Dancy & Son, Limited; cut stone, George Oakley & Son; structural steel, Canada Foundry Company; carpentry, Thos. Painter & Son; roofing, G. Duthie & Son; lathing, plastering and cement block work, Hoidge & Sons; painting, J. McCausland & Son, Limited; glass, N. T. Lyon Glass Company, Limited; plumbing, heating and ventilation, John Ritchie Plumbing and Heating Company, Limited; electrical, Keiths, Limited; vacuum cleaning apparatus, Zimmer Vacuum Machine Company; steel sash and metal casement frames, Henry Hope & Son, Limited; book stacks, Snead & Company Iron Works; bookcase shelving, magazine racks, etc., Lindsay Library and Office Fittings, Limited; elevators, Otis-Fenson Elevator Company; pink Tennessee marble base, treads, risers, strings, Marbles & Tiles, Limited; steel work for stairs, Toronto Structural Steel Company, Limited; balustrades, McGregor & McIntyre; terrazzo, cement and quarry tile, Italian Mosaic & Marble Company; concrete walks, A. Gardner & Company; five pairs Crittall solid steel doors, Crittall Casement Company; hardware, Canada Hardware, Limited; guards for windows, Geo. B. Meadows; electrical fixtures, McDonald & Willson.

The architects were Messrs. Chapman & Giffin, of Toronto.



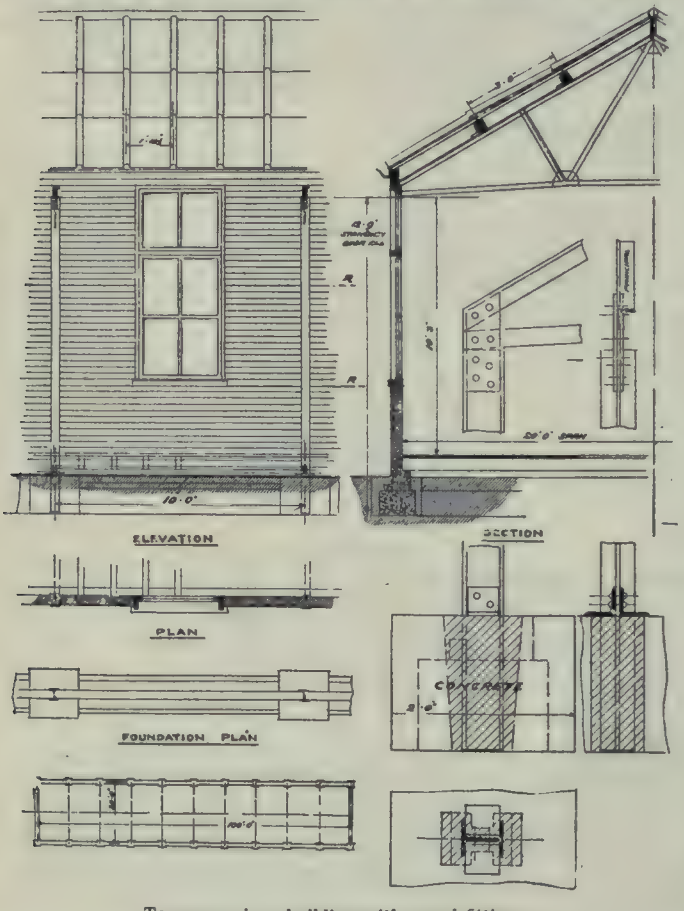
The educational value of moving pictures is being demonstrated by United States contractors, who have adopted this means of teaching the public how big operations are handled. An experiment in this direction is being made with the Third National Bank Building of Springfield, Mass., a ten-storey bank and office structure in course of erection by Hoggson Brothers, of New York. The complete history of the work will be shown on the screen.

The concrete contractors of the Memphis (Tenn.) Builders' Exchange have formed an organization to maintain "fair and honest competition." Cost records which will be kept are to be for common use, in an effort to discourage incompetent and irresponsible "curb contractors."

The Construction of Temporary Buildings Adapted to the Emergency of the War

Rapid Method of Erection Described by The London Building News.

With timber supplies restricted, prices high and tending to advance, it is more desirable than ever to consider the scope that may exist for temporary building in other material than wood. Apart from the question of first cost there may be occasions where a more solid form of structure may prove best suited to specific duty. Among systems of construction suited to rapid building is that of light steel stanchions filled in between with some thin and inexpensive panelling, as brick flat(on-edge, or concrete slab. Of these, if obtainable, a thin waterproof slab offers advantages. Brick panelling would no doubt often prove convenient, but it would entail some exterior waterproofing, or cover, such as cement stucco; and, to promote equable temperature, interior plaster with air-space.



Temporary iron building with panel fittings.

On these general lines we shall consider the construction of temporary buildings suited to the present emergency. Our sketch shows a building on this system. In the case of a quite temporary structure, the stanchions would be very light, and the panelling very thin, either 4½-in. brickwork or 3-in. brick-on-edge, or, say, 2-in. or even 1½-in. concrete slab. In all cases, as we have suggested, it would be necessary to prevent the penetration of rain.

It is to be noted, at the outset, that whereas we cannot, even for temporary work, space quarters more than, say, 1 ft. 6 in. apart, we only need steel posts under each roof truss, say at 10 ft. centres. In normal times we can cover, say, 100 ft. by 20 ft. by means of nine light steel roof trusses for £27, or less. Adding 22 stanchions at the cost, say, of £25, including all cutting, riveting, angle connections and bolts, nothing more in the way of steel would be needed, since panelling and window would fit in between the stanchions and give longitudinal stability to walls, leaving the matter of cross stability to some means of holding down the stanchions to earth, of tying the heads to roof trusses, or a combination of these methods; for we cannot, as when dealing with substantial brick walls, of ordinary thickness, rely upon the walling to resist wind pressure.

Our suggestions generally refer either to half-brick walling, brick-on-edge, or concrete slab. Taking the first, the 4½-in. bricks should fit snugly between the flanges of the stanchions. For a 20-ft. span the steel roof truss would weigh, say, 4 cwt., and allowing for load and wind $\frac{8{,}000 + 448}{2}$ or 4,224 lbs., this would represent the weight upon each stanchion; but the steel reinforces the wall, and the wall stiffens the steel, so that if we can assure that the post is held firmly upright, we can do with a very light section. Since we are considering brick flat as mere convenience in fitting between the flanges, a 5-in. by 4¼-in. section would suggest itself.

We are holding primarily in view as economical a structure as possible. As, therefore, we are endeavoring to cut down strength to a bare margin of safety, the question of wind pressure is of interest, since, for one thing, the type of building might be well suited to exposed positions, experiencing the full stress of winter gales. If nothing occurred to cause a tendency for the thin wall to overturn, the mere weight of roof on a half-brick wall in cement mortar is not of great moment; in another way of putting the position we could place our trusses anywhere, irrespective of the location of stanchions; hence we should, in this special form of building construction, look upon the stanchions as wall stiffeners. By reason of the structural necessity of bolting the truss to the stanchion, we superimpose the one over the other. If the rigidity of structure depends on the tie of truss to stanchion-head, wind, to cause disaster, must be sufficiently powerful to rupture this tie; if the stability depends on stanchion connection to earth, this resistance must be broken down before the building is wrecked. In ordinary cases, no doubt, a roof-truss shoe, well bolted to a stanchion-head, provides all resistance needed; but where we wish to cut down the weight of steel as much as possible, it is advantageous to well anchor the post to the earth. In emergency building, and for temporary building, we should, with shortage of skilled labor, endeavor to avoid elaborate design and work, as in base-plates, anchorage, and head-plate connections, seeking to keep all labor on steelwork to cutting to lengths and simple drilling and riveting. We may effect this object in ground anchorage of stanchions, avoiding real base-plate construction, by proceeding much on the old gate-post principle, bedding the stanchion ends in concrete blocks. The concrete could be laid with recesses ready for the posts, and these latter being plumbed and secured as soon as, or soon after, the recess is grouted, the concrete grips the steel; and if the general foundation is homogeneous cement-concrete, to overturn the stanchion we must overturn the foundation, or cause a rupture, neither of which is a likely event, excepting in a country of tornadoes. The stability of hollow, barn-like structure of the type skeched is greatly assisted where the foundation grips the post.

These considerations are to the point, because we desire to keep down cost of construction to the utmost. We do not wish to put a pound of unnecessary steel, in these days, in temporary or emergency building, nor to use superfluous walling material; and as regards this latter point, we may argue that inasmuch as rain may penetrate 4½ ins. of brickwork, 2 ins. of walling material would be as good as 4½ ins., since in either case we must do something to make the structure waterproof. Hence we might consider that 2 ins. of material, such as slab, would fit into 3-in. by 3-in. H stanchions, weighing 8½ lbs. per foot, and, stiffened to some extent by the rebated or grooved walling in cement mortar, suffice to carry less than two tons of load, even if—for orthodox, permanent construction—the 3-in. by 3-in. be outside the generally accepted ratio of slenderness. With a real grip on foundation and an efficient tie above, the steel post is greatly strengthened. Again, when an efficient roof truss sits squarely upon a stanchion head, the resultant stress may be said to partake of the nature of a balanced or "concentric" load.

The accompanying sketch was prepared to illustrate generally the considerations we have suggested, and to form a basis for argument rather than of insistence. The drawing shows stanchions set 10 feet apart centre to centre, and it may be worthy of remark that we might employ steel in this manner, and yet, with some very light woodwork, compressed asbestos sheets as walling. The idea may be carried out either in brick panelling or some suitable form of slab, and in the event of a yet more advanced price of scantling timber, be found suggestive. We need, however, to remember that steel is in urgent demand, and greatly advanced in price. For this reason we have suggested that the stanchions should be as light as possible; and since, in this particular panel construction, they should be regarded not so much as true pillars, but as wall-stiffeners—much, indeed, as reinforcement—we have suggested that the full value of the steel should be obtained by seeing that the posts are securely anchored to the ground. The scheme was sketched to scale of 4½-in. brickwork and 5-in. by 4¼-in. joists as stanchions. Taking a building or shed 100 ft. by 20 ft., we may compare this with the timber-framed method. We will assume 10-ft. walls, stanchion construction on the one hand and quartering on the other. Putting an extra steel post at each end, the whole number of stanchions is twenty-four. Allowing that the quarters in a temporary timber-framed building are 1 ft. 6 in. apart, there would be some 80 c. ft. of timber in 4-in. by 2-in. posts, as against, say, 5,800 lbs. steel in 5-in. by 4¼-in. stanchions, giving these extra length to bed well in concrete, as a simpler system of ground fastening than genuine base-plates and anchor bolts, and more suitable where unskilled labor is involved. Taking that which would appear to be the limit in constructive lightness—3-in. by 3-in. H stanchions and 2-in. grooved-and-tongued concrete slabs—the steelwork would be reduced to less than half, say 2,900 lbs. As to roofing, there is considerable timber in a roof with each pair of rafters tied by a collar. Taking the 100 ft. by 20 ft. proposal, and allowing, for temporary construction, say 1 ft. 6 ins. between the rafter centres, there would be some 120 c. ft. of 4-in. by 2-in. rafter and collar, as against the nine light steel trusses. It is true that with the arrangement shown in our sketch there are purlins, pole-plates, and ridge-piece to the extent of about 100 c. ft., which somewhat alters the outlook. In comparing, therefore, a collar-beam roof and one with light steel trusses, we must bear in mind the expense of purlins. A way out, possibly—and we are endeavoring to omit all superfluous timber—would be the employment of Z steel purlins, say 8¼ lbs. to the foot. Light steel offers many advantages in purlin construction, where timber is dear. Inasmuch as that cleats are required to secure wood purlins, whilst drilling the principals for these we might make provision, with no more labor, for fastening the Z steel to the truss.

The sketch discards any more elaborate means of fixing steelwork than by cut angle-pieces or plain sawn plates. The stanchion is shown bedded in concrete, the cross-hatching on detail being a suggestion for leaving a sinking in the concrete block, to be finally grouted, the exact position in building being located, and the post plumbed, by means of angle-pieces riveted to the web, and taking bearing on concrete finished to a true and level surface. To connect the stanchions to the trusses in place of the ordinary shoe are shown two cut-plates, which are riveted to the feet of principals and tie-beams and bolted to the web of H stanchions. As drawn to scale, and as designed, no doubt in place of suggesting a temporary structure, it might be considered suited to quite permanent work and of superfluous strength. Structure of this nature, and no stronger, has been found extremely useful in ordinary commercial building, and would be found particularly so where firms have, in emergency, as to fill urgent contracts, to suddenly extend their premises. The sketch is put forward rather to be suggestive, and the remarks above made as to wind-pressure, stanchion and panel construction and strength bear upon the point of how to reduce steel to a minimum rather than as referring to the design and details shown. To reduce cost it is necessary to gain correct ideas on the method of construction, and to get the utmost out of every pound of steel we must see that it is secured in the best manner.

The roof trusses would be ¼-in. steel only, with ½-in. bolts and rivets, where in permanent work we should use ⅜-in. steel; and in place of 2½-in. angles and bars, say, 2-in. only; and connections and angle-pieces in ¼ in. in the roof and ⅜ in. in fish-plates and angles to stanchion connections and quasi base-plates. The panelling is shown in brick flat, and where there are no windows might be reinforced, as suggested at R.R. The window is in deal rebated linings, with deal sill and transom and stops against the underside of the pole-plate, which finishes the walling and gives a fixing for the gutter. Since the weight of the roof is chiefly upon the stanchions, and there is little upon the wall itself, very little wall foundation is required, but a larger block of concrete is shown in which to embed the stanchion ends.

With timber at present prices, and the uncertainty as to the future, and assuming steel procurable even at present enhanced prices, it is possible that there would not be a very great difference in the cost of erecting similar sized buildings in 4-in. by 2-in. timber framing and in the method shown and one or the other of the panel materials discussed. But it would be necessary to use and dispose steelwork with the utmost economy. We advance this opinion with caution, but as it is well to look ahead and consider all suitable methods we have put forward a practical alternative to timber. It should be remembered, too, that there are many uses to which steel and slab construction can be put, apart from those immediately attendant upon or the result of war.

Progress on the Registry Office Building, Toronto

THE new Registry Office which is being erected by the city of Toronto to house its Registry and Land Titles departments is rapidly nearing completion. The building consists of two storeys and basement, and is built on three sides of a rectangle, 135 feet by 165 feet, with a light court running through the middle of the building to the rear. The principal feature of the main facade is the portico. This consists of eight Ionic columns supporting an entablature and parapet wall, and is approached by an imposing flight of steps between two flanking walls. The entablature and parapet wall are continued around the building, being supported on the east and west facades by a number of pilasters carried up between the windows. The columns of the portico are fluted, and constructed of five drums, while the crown and bed moulds of the cornice and the capping mould of the architrave are enriched with carved ornament. The main entrance doorway is embellished with a canopy, supported on two scroll brackets.

Competitive plans for the building were invited by the Board of Control towards the end of June, 1913. The first prize was awarded to Mr. C. S. Cobb, who was commissioned to prepare working drawings and specifications. Considerable delay was experienced in this work, owing to the sudden decision to include the Land Titles Department in the building. In the spring of 1914 work was started on the wrecking of the premises on the site, and tenders on the construction of the building were called in the early part of July. Contracts were awarded at the end of that month and a start was made on the work.

The structure consists of a steel framework on concrete foundations, brick walls faced with Indiana limestone, and a felt and gravel roof. The steel was supplied and erected by the Toronto Structural Steel Company. The walls are built of yellow brick, manufactured by the Don Valley Brick Works. The light court is faced with a pale shade of buff brick, in order to reflect as much light as possible. The masonry was carried out by James A. Wickett, Limited, and the cut stone work was executed by George Oakley & Son, both Toronto firms. The Indiana limestone used lends itself very readily to carving, as the results indicate.

Registry Office, Toronto, under construction.

The interior of the building will be finished in plaster. In the main offices the concrete floors will be covered by cork flooring. A certain amount of Grey Tennessee and Regina marble will be used in dadoes and on the stairs. This marble will be supplied by the Missisquoi-Lautz Corporation, Limited. The windows will be fitted with steel sash manufactured by Henry Hope & Son.

A three-sweeper five horse-power Tuec Stationary Vacuum Cleaner is being installed in the basement for the sanitary cleaning of the building. Four two and one-half inch risers will be installed in the building having a total of sixteen inlet valves, so that not more than fifty feet of hose will be required to clean the whole structure.

A vacuum steam heating system is being installed by Purdy, Mansell, Limited. The plant consists of standard type horizontal tubular boilers equipped with smokeless furnaces manufactured by the John Inglis Company, Limited, of Toronto. The pumps were made by the Bawden Machinery Company, Toronto. The main portions of the building are ventilated and supplied with water-washed and tempered air.

Improved Chuting of Concrete*

IN the days when the gravity chute was more or less of an experiment many contractors saw therein a means of placing concrete economically, and in order to make "records" with the rather crude apparatus then available (compared with the up-to-date spouting plant), the concrete quite naturally was mixed very wet to insure its "flowing" in the chute. Then, also, there was a tendency to cut down the time of mixing, since no difficulty was experienced in getting the concrete away from the mixer, as had been the case with other methods. These two conditions naturally produced results which raised a storm of adverse criticism from engineers, for the great amount of laitance (decomposed cement formed in the presence of an excess of water) present did, without question, weaken the concrete. In one case with which I am acquainted a great number of laitance spots were found in a slab placed by chute. These never did harden and could be dug up easily with a knife to a depth of an inch or so. This without question was due to the excess of water used. The basis for the widespread criticism of gravity spouting of concrete was well-founded, and contractors and manufacturers were quick to realize that unless something were done to remedy the apparent faults, this type of apparatus would be barred by engineers and owners.

Accordingly, careful study was made of the proper angle of chutes and the consistency of concrete required to enable placing the concrete without the excessive use of water. It was soon found that, with a certain minimum angle of chutes, concrete mixed to the consistency of a thick gravy and having no excess of water would flow readily—such a mixture being surprisingly slippery and possessing a sort of oily smoothness. The addition of a small amount of hydrate of lime (up to 10 per cent. by volume of the cement) was also found to make the concrete flow more readily. To produce a mixture wherein the stone is held in suspension and the entire mass clings together requires more thorough mixing than is usually done, and herein lies the whole secret of chuting; excess of water is not required.

With a little experience the man at the mixer can tell, by the following indications, whether the concrete is of the proper consistency to flow well in the chutes: If, when dumped into the skip or hoisting bucket, the concrete stands up in a pile, it is too dry and requires additional water and more mixing. If it levels off and shows a covering of water, it is too wet to hold the aggregate.

Not only must the mixture be right to insure successful operation, but the flow of concrete should be steady and continuous by proper regulation at the distributing hopper at the top of the tower. Increasing the time of mixing may make this last condition difficult of fulfilment, but this can be accomplished easily by having two mixers at each plant instead of the one usually seen.

Concrete chuting has come to stay because of the great economy of operation; it is the duty of the engineer to aid in obtaining the best results, rather than to forbid its use. Given a well-designed plant, all that the engineer needs to do, as his share, is to see that the concrete is properly mixed before being discharged into the chutes. This will remove the one great objection and actually result in stronger concrete than we now obtain with rapid mixing, even if there is no excess of water present. A paper read by H. H. Scofield before the Indiana Engineering Society gave the results of tests to ascertain the effect of mixing on the compressive strength of concrete. These tests showed that the strength was increased by from 27 per cent. to over 50 per cent. by lengthening the mixing periods from 10 to 18 min. over that of the usual ½ to 1 min. It would be impossible, of course, to increase the time of mixing quite so much, but with the aid of the mixer manufacturers, by building machines of higher speed, beneficial results can be secured.

Summing up the situation, the popularity of the gravity spouting system of concrete distribution can be increased still more by the use of high-speed mixers, a slightly increased time of mixing and careful supervision.

Corrosion of Naked Steel Bridges

IN a paper read to the Engineers' Society of Western Pennsylvania, Mr. Frederic H. Fay, formerly Divisional Engineer in charge of bridges and ferries, City of Boston, discusses the serious deterioration of steel bridges.

Experience in Boston has shown that the corrosion of metal bridges has been due principally to one or more of the following causes: exposure to locomotive gases; exposure to sea water; exposure to surface water leaking through bridge floors; over-stress of the metal, by which corrosion has been hastened.

Striking examples of corrosion are to be found in the Washington Street bridge of the Boston and Albany railroad. The webs of the plate girders beneath the bridge floor have been completely eaten away over large areas, leaving holes, which, in some cases, are large enough for a man to crawl through.

Paints have not proved any effectual protection of metal work under extreme conditions, such as exist in bridges over railroads. The use of wooden ceiling protection confines the locomotive gases and makes corrosion more rapid than in the open. Sheet lead has, in some cases, been worn away by locomotive blasts until it began to fall upon the trains beneath.

Mr. Fay says that concrete or cement mortar has proved by far the most satisfactory protection for metal structures over railroads. It should be properly reinforced with steel, the best results and the greatest degree of safety being obtained when the reinforcement is thoroughly attached to the metal members.

The present decade marks many new uses for cement. At the 60th General Meeting of the Institution of Mining Engineers, held recently in London, an interesting paper dealt with the sinking and equipment of a large coal mine in the Durham district.

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*By A. M. Wolf (Principal Assistant Engineer, Condron Company, structural engineers) in The Engineering News.

The Design of Substructures for Wooden and Combination Highway Bridges

Of the structural materials suitable for use in bridges the most common are: steel, concrete (plain and reinforced), masonry and wood. The larger, more expensive and, scientifically, the most noteworthy bridges, include in their principal parts only the first three and, because of this fact, the last named material has almost ceased to be considered one of the important structural materials if current engineering literature may be considered an index of engineering thought.

It should not, however, be forgotten that wood still occupies an important part in many bridge structures, and it is a question whether or not greater familiarity with other structural materials does not in some instances cause their selection when wood could more economically (using the word in its broadest sense) be employed. Cases involving the following conditions should be particularly examined to prevent the error just suggested:

(1) In many localities timber is cheap and the manufactured articles are expensive. Such conditions usually prevail in new and timbered countries where timber is close at hand and factories distant, and where transportation is expensive. Lumber may often be used and structures replaced at the ends of their periods of usefulness at less annual cost than the interest on the investment required for more permanent works.

(2) The limitations of available funds often dictate the cheapest construction regardless of economic loss in the long run. This is particularly common in the highways built by townships and counties in our western states.

(3) The probable period of use of a structure may be short. Even though its period of use will probably be longer than the life of a single wooden structure the economic advantage may be in favor of wood.

(4) Hasty construction to meet an unexpected emergency or to provide emergency repairs to damaged communications may be necessary.

The wide range of conditions covered by these four cases is evident. It will also be evident that cases (1) and (4) may prevail on either roads or railroads, but cases (2) and (3) will rarely apply to the latter. In the above cases, case (4) applies to most military bridges. The following data deal with the use of wood as an important structural material in highway bridges intended for permanent use during the life of the materials of which they are constructed. This article will treat only of the design of the substructures.

DESIGN OF SUBSTRUCTURES

Location.—The most desirable type of substructure, and consequently the general type of a bridge, is fixed by the conditions at the bridge site. In the selection of the site all of the details of bridge construction must be considered in a general way unless the site is fixed by other conditions than that of putting the most suitable bridge across a given stream. Usually the site is fixed within comparatively narrow limits, and the bridge engineer is concerned only with the comparisons of the various sites that are available within the limits beyond which the crossing may not be sought. A stream can be crossed anywhere, but the problem is to select the site that will allow the construction of a bridge to answer the desired purpose at the least ultimate cost.

Often the selection of the best site is easy, being evident to the most inexperienced eye; frequently it involves only a rough mental approximation of cost; but in many instances the most satisfactory site can be selected only by careful studies of the types required by the several available locations. In such cases the knowledge of what can be done, how it is accomplished, and how much it costs in the particular locality is essential. No rules can be given, but the following are desirable features of the site, named in what is frequently their order of importance: solid bottom, permanent banks, straight upstream reach, small width, low velocity current, single current or parallel currents, good approaches, and shallow water. Few bridge sites afford all of these advantages; some offer few; and others none.

As noted in the preceding paragraph the best type of bridge is fixed by the purpose to be served and the site selected, and where there is a choice of suitable sites the bridge required at each is more or less definitely determined in the processes of their comparison. In general, three conditions govern the design of the substructure: first, the supporting power of the foundation; second, the probable effect of the current; and third, the height of the grade crossing. Wood not being adapted to extreme spans, in the construction of wooden highway bridges, troublesome foundation pressures are rarely encountered. The current effects include scour, drift, and ice, in addition to the dynamic force of the flowing water itself, which is usually insignificant. The height of grade crossing determines the proper spans by economic considerations when the most suitable spans are not determined by the preceding factors. Since the cost of piers of a given type and height increase with their number, and since the cost of superstructure increases with the length of the spans (for a given height and type of pier) there is a single span length of maximum economy. Generally, however, except in elaborate work, the advantages of standard construction avoid the necessity of hair-splitting studies. The type of wooden substructures suitable for various conditions will be outlined in the following paragraphs:

Trestle Bents.—Because of the short span and consequent wide distribution of pressure almost any soil is capable of supporting either framed or pile trestles, and they are at present more widely used than any other type of wooden substructure. They offer, however, slight resistance to current effects, and because of their obstruction to the channel are particularly susceptible to damage by ice and drift, being liable to destruction either by the simple force of impact, or in unstable bottoms by the increase of scour resulting from the lodgment of ice and drift against the bents.

Framed bents on mud sills can not be considered safe except in stable bottoms. Pile bents or bents on pile foundations are ordinarily safe against scour if the piles penetrate a solid clay stratum to a depth of 5 ft. or more, and in softer bottoms if the penetration of the pile is at least equal to the maximum observed depth of water. Safety in the last case is contingent upon the prompt removal of drift from lodgment against the bridge. The dynamic effect of the current is not dangerous in current velocities ordinarily encountered, but drift in rapidly flowing streams may be dangerous and in streams having a distinct "break-up" or ice run, trestles can not be considered safe.

Framed Trestles are used where the soil near the surface is sufficiently compact to support the bents and where scouring effects are small. They are ordinarily constructed only where the water is very shallow. The posts should rest on a mud sill, usually a square or round timber with a width not less than that of the posts measured perpendicularly to the bent. The sill should be notched to receive the feet of the posts, and the posts should be toe-nailed to it by one or more spikes in each side of the post. Framed bents may also rest upon pile foundations. Such use is limited to sites in which the bearing power of the soil is poor or difficulties in properly seating the mud sill exist, and where piles of sufficient length to form the entire bent are not available. The foundation is constructed as a pile bent, the cap of the bent taking the place of the mud sill. The bents ordinarily contain four posts. The posts should be equally spaced, the tops of the outside posts falling under the guard rails of the bridge floor. In unusually wide bridges additional posts can be used to decrease the size of the cap. Posts are designed as columns after any standard tables of strength (such as Kidder's "Architects' and Builders' Pocketbook." In the use of local timber due allowance must be made for the quality of the sticks secured. In Alaska, where the native spruce is injured by irregular growth due to the climatic conditions, the writer has usually employed a factor of 60 per cent. in reducing the strengths given for spruce in Kidder's tables to obtain the strength of sound Alaska spruce). A minimum diameter of 6 ins. should usually be required. In bents under 6 ft. high the posts are vertical; in higher bents the outside posts should usually be given a batter of 2 or 3 ins. per foot. In bents higher than 6 ft. sway bracing of 3 x 10-in. planks, one on each side diagonally across the bent, bolted to the mud sill at one end, to the cap at the other, and spiked to the posts, should be employed. In lower bents sway bracing should be used where current forces against the bent are to be expected.

The cap should be designed as a beam with its width that of the post measured perpendicularly to the bent. It may be given shallow notches to receive the tops of the posts, to which it should be drift bolted to each post with one or more ½-in. or ⅝-in. drift bolts.

Pile Trestles are used where foundation difficulties are met. These difficulties may be in the form of insufficient bearing strength of the surface soil, in the depth of the water, or in probable current effects. The number of piles may depend upon the bearing power developed; usually, however, not less than three piles to the bent are allowed, and that number is sufficient in most cases. In the determination of the safe load on a pile the common formula given below is recommended:

$$\text{Total safe load} = \frac{2wh}{s + 1},$$

where w = weight of hammer, in pounds.
h = height of fall, in feet.
s = penetration under last blow, in inches.

It is of value only when the penetration under the last blows is approximately uniform. In extremely high bents the strength of the piles as columns should be examined. Ordinarily, piles should not be under 12 ins. in diameter at the butt and 6 ins. at the tops. For convenience in driving they should not exceed 18 ins. in diameter at the butt. They may be driven with the bark on, if the superstructure is to be made of logs or hewn timber unseasoned, or if driven in salf water; otherwise they should be peeled, and if the superstructure is expensive and is to receive careful maintenance, painting, etc., they may be creosoted, depending upon the circumstances under which they are to serve and the cost of the process. Pile bents are capped and sway-braced like frame bents. The bottom of the sway bracing is usually at a horizontal sash brace, at the surface of the ground or at the low water line. The sash braces should be two 3 x 10-in. planks bolted to the piles, one on each side of the bent. High bents, requiring storied construction or longitudinal bracing are not common. When found economical, however, they are used, the longitudinal bracing and the sway bracing being computed from the estimated maximum wind loads, etc., instead of by the arbitrary adoption of the sizes given above.

Piers.—When spans longer than 20 ft. are desirable the substructure of the bridge consists of abutments and piers. The supporting power of the foundation may require the adoption of long spans, when the bottom of the stream presents variable soil conditions, so that suitable foundations can be secured only at certain points on the crossing. This condition is rare and the long spans are usually made desirable to avoid obstructing the channel, or because of the necessity of protecting each pier from scour, drift or ice, or because of the height of the grade crossing. The first and last conditions being questions of foundation pressures only, their solution depends merely upon special adaptations of the principle of trestle bents. Ordinarily, each pier is made up of the two simple bents under the abutting ends of two consecutive spans. They are designed as ordinary framed or pile bents, taking into consideration the increased loads of the longer spans. They are braced to each other by a system of cross bracing if necessary—practically always if framed bents, and usually if pile bents over 8 ft. in height. The usual type of timber piers designed to withstand the effects of currents will be considered under the heads of "Pile Piers," "Crib Piers," and "Pile and Crib Piers."

Pile Piers

Pile piers may be used when the spans have been increased to allow the passage of drift and may be considered useful in withstanding very weak ice flows. The length of span should be safely greater than the possible length of single pieces or booms of driftwood, in which case properly designed and constructed piers can usually be depended upon. Pile piers under 10 ft. in height can be expected to stand a run of ice; pieces not exceeding 10 cu. ft. in size in currents up to about four miles an hour, or proportionately smaller pieces in more rapid currents. (In this and similar proportions mentioned later the mass of the piece is inversely proportioned to the square of the velocity of the current.) For greater impact forces their safety should be considered doubtful. The bearing power of piles carrying vertical loads can be determined as previously noted. If piles are expected to withstand forces having large longitudinal components they can be examined as cantilevers where the stresses are calculable. Piles to withstand the impact forces of ice and drift should penetrate a firm stratum—clay or gravel—not less than 6 ft. nor less than the distance from the highest point of impact to the surface of the ground. Pile piers can not be depended upon where thick ice can freeze to the piles and be lifted by rising water. The general remarks previously made in regard to peeling, creosoting, etc., apply to pile piers.

A pile pier of the type under consideration consists of two parts: the supporting pier, or main pier; and the nose, or guard pier. The main pier is composed of two pile bents separated 4 ft. to 8 ft. The number of piles, the sway bracing, and the longitudinal cross bracing are dependent upon the penetration, the bearing power of the piles, the length of the spans, and the height of the piers, according to the principles previously indicated. Cross bracing is important if the piles of the guard pier are braced to the piles of the supporting pier. The nose or guard pier may consist of a single dolphin or group of three or more piles driven as closely together as possible and with their tops bound together by a cable or metal strap. This should resist ice and drift under conditions that make the stability of pile piers of some little doubt, but cannot be expected to resist ice or drift in swift currents. A better form of nose consists of several piles driven in a row upstream from, and opposite, the centre line of the supporting pier. The upstream pile should be cut off 2 to 3 ft. below the probable height of the water line at the time of drift or ice flow. The other piles should be cut off at increasing heights toward the pier and all should be cut at such an angle that a nose log can be drift-bolted to them. The angle of the nose log with the horizontal may vary from 30 deg. to 40 deg., decreasing as the probable impact forces increase. The nose log should be about 12 ins. in diameter, it should be supported at not greater than 4-ft. intervals, and should be drift-bolted to each pile with two ½-in. or ⅝-in. drift-bolts, one on each side of the centre line of the nose log. A light metal strap or a light railroad rail should be spiked to a round nose log if ice is to be resisted. If the nose log is square, the rail, or two small angles, one at each upper edge, may be used. This form of nose is capable of standing heavy impact forces if the current is parallel to the centre line of the pier. It can not, however, be expected to resist an ice jam.

Can We Increase the Volume of Engineering and Building Construction in Winter?

This question, which is discussed editorially on page 1049 of this issue, is one of economic import at all times, but more especially just now. We ask you to read the article carefully and to submit your views and experience for publication in a later issue.

Crib Piers

Crib Piers.—Many of the functions of crib piers overlap those of pile piers to a considerable extent, most of the functions of pile piers being equally well performed by cribs. In such cases the particular type to be employed depends upon the facilities for erection. Crib piers, however, have certain special adaptabilities and limitations. They are more suitable than pile piers in locations subject to variations in the direction of currents at varying water stages, to locations where hard strata are at insufficient depths to give lateral support to piles, and to locations subject to ice jams. They are not so suitable for unstable bottoms (though they may be used with mattress protection), for sites in which confinement of the channel is objectionable, and for sites requiring piers of great height. Well constructed crib piers over 8 ft. in height should stand a considerable amount of impact from drift and ice. They are safe under almost all ordinary conditions of drift, and should stand an ice run with pieces about 3 cu. yds. in a current of four miles an hour and proportionately smaller pieces in swifter currents.

Cribs may be built of logs or squared timbers. The sticks used should have a minimum diameter of 8 ins. If logs are used, they may be peeled, but in most cases the advantages of peeling does not warrant the expense. The main body of a crib will usually be rectangular, 16 to 24 ft. in length and 8 to 12 ft. in width, inside dimensions. The exact size of the pier depends upon the weights to be supported, the impact forces to be resisted, and the height required. It is ordinarily divided into compartments by cross ties, separated about 4 ft. horizontally and that distance or less vertically. If the crib is to be sunk into a soft foundation the first row of ties should be far enough above the bottom of the crib to permit the required sinking, and a floor should be put in on these ties. Otherwise, flooring is not required unless the crib is to be sunk in water deep enough to float the crib. In this case a portion of the crib may be floored.

The logs or timbers may be halved together at the corners, making a tight crib, or simply laid alternately (a long log and then a cross log) making a crib with openings the size of the timbers. Usually, with round logs, both logs should be flattened to a bearing surface about 4 ins. wide on each side, and with squared timbers they should be laid without notching. Each log or timber is bolted to the log below with one ⅝-in. drift bolt long enough to reach through the first log below and to extend about 2 ins. into the second log. These drift bolts may be shorter above and below the points at which impact forces are to be expected, except that in piers over 10 ft. high the lower bolts should not be shortened. In addition to the rectangular body, piers subject to the attack of drift and ice should be given a wedge-shaped nose upstream, and in unstable bottoms with rapid currents, a short wedge-shaped tail. The body of the pier should be built like a rectangular pier, but with the long logs extending beyond the cross logs a sufficient distance is required to allow them to be framed and drift bolted to the wedge logs. The upstream nose should generally have a vertex angle of about 60 deg. at the line of greatest impact. The wedge logs should be framed at the vertex, as described for the corner of a rectangular pier, the ends extending sufficiently to allow a bearing of not less than 6 ins. for the nose log. The vertex angle of the wedge increases from bottom to top to give the nose log a slope. The remarks regarding the size, slope, metal protection and bolting of the nose of a pile pier apply to the nose of a crib pier. The tail wedge is usually not necessary. When required to prevent the formation of a suction eddy it is usually made with a vertex angle of 90 degs. It is framed like the nose, but without a nose log and with a constant angle at the vortex, making the tail line vertical. The tail wedge should be carried to the high water line.

Cribs are filled with stone, at least to the highest line of probable impact. The size of the stone is unimportant, except that it must be larger than the openings between crib logs; it is usually large enough to be handled one stone at a time and not larger than one or two-man stone. The stone should be placed well against the walls, smaller pieces being wedged into spaces between larger stones and the crib logs. The spans of the superstructure rest on caps, one for each span. The caps usually rest on stringers which are supported by the crib walls, from which the caps are set back 2 ft. or more, frequently being placed one-quarter of the distance from one wall to the other.

Pile and Crib Piers are used where strength greater than that obtainable with simple cribs is desired. They are particularly useful in soft bottoms where cribs can not be expected to stand without settlement from time to time, unless sunk to impracticable depths. When the length of the crib is small, the addition of the piles greatly increases its resistance to impact; as the height increases the value of the piles becomes less. In cribs that may reasonably be suspected of liability to even small settlement the supporting piles should be added if the superstructures are expensive. A well constructed pier of this type will resist a heavy ice run, and by increasing the dimensions it can probably be expected to withstand any but the most severe ice jams.

The simplest form of pile and crib pier is composed of a crib constructed according to the principles already given, but with the trusses supported on pile bents extending through the cribs and driven into the underlying bottom. The caps of the piers take the place of and occupy the positions recommended for the crib caps, the crib stringers being omitted. A complete pile and crib pier is constructed like the crib pier described above, but with an additional pile at each corner of the rectangular portion of the pier and with piers along and against the walls of the rectangle and the nose. All of the piles are inside of the cribs and should be about 4 ft. apart. The logs are then drift bolted to the piles with ⅝-in. drift bolts. This construction adds greatly to the strength of the pier, being particularly a protective measure against damage to the pier and the supporting bents caused by excessive settlement of the pier itself. Piers of this type should not be floored, and when the filling settles the crib should be filled as soon as possible.

Abutments.—The approaches to bridges of wood will usually be pile or framed bents, if of considerable length, and in any case will usually terminate in a single mud sill for the support of the floor stringers. When built-up abutments are necessary the best form of wooden construction is usually a vertical river wall parallel to the bank of the river and with vertical wing-walls. The river wall and wing-walls are constructed like a side wall and the corresponding wedge walls of a crib pier. The wing-walls, where oblique, usually make an angle of 45 degs. or less with the river wall. The ties of the crib construction are replaced by headers extending into the bank or fill behind the abutments, according to the rules for spacing given for the ties. Frequently the wing-walls will be perpendicular to the river wall, and when so placed the ties can be omitted. Another type of abutment is constructed of piles and sheathing.

If scour beneath the abutment is expected the abutment may be supported by piles driven behind and against the wall. The logs of the wall should be drift bolted to the piles. In this case the filling next to the wall should be of stone, and if it sinks it should be replaced as soon as practicable. Abutments built as indicated can be considered safe under any condition of ice and drift that make pile and crib piers permissible. Their greatest danger is from the effects of bank erosion, which must be cared for when necessary by mattress or other form of bank protection.

The foregoing data were abstracted by Engineering and Contracting from a paper by Capt. Glen Edgar Edgerton, Corps of Engineers, U. S. A., in Professional Memoirs for July-August, 1915.

New Westminster Court House Enlarged

THE Court House at New Westminster, B. C., has been enlarged by an additional wing costing $80,000. The new building provides accommodation for the provincial police and sheriff. The contractors were the Dominion Construction Company, of Vancouver, the work having been carried out under the supervision of Messrs. Gardiner & Mercer, architects, of New Westminster. The exterior of the building is in artificial stone made on the site of the work by the Monarch Art Stone Company, of Vancouver. The pressed brick-work is of Clayburn brick. With the exception of the brick all material used in the building was obtained and manufactured locally. The whole of the interior finish, including the furnishing of the court room, was installed by Galbraith & Son, of New Westminster. The passenger elevator installed is by P. Harris & Company, Vancouver.

Addition to Court House, New Westminster, B C.

The cost of engineering and superintendence in St. Louis for $1,404,316.49 worth of new construction in the water department was 3 per cent., according to the latest annual report.

Simple Construction at Low Cost Reclaims Seven Thousand Acres of Rich Land in British Columbia

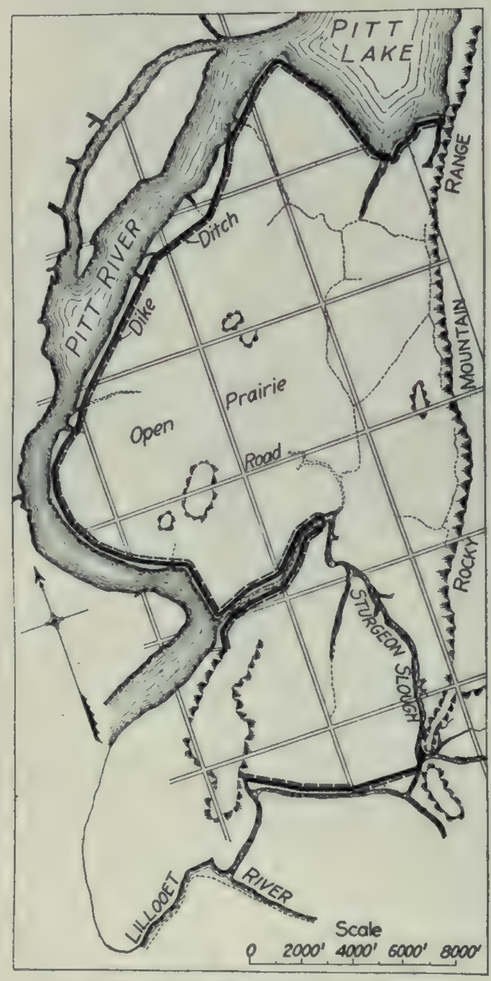
Dike prevents flooding, while flood-gates normally and pumping plant in times of high water handle rain and seepage water.

By H. M. Burwell, C.E., Vancouver.

PERIODIC flooding of seven thousand acres of rich meadow land has been prevented and its use for agricultural purposes made possible by construction costing only $109,000. This territory, known as Pitt Meadows, is situated along the Pitt River and Pitt Lake in the lower Fraser Valley, about twenty miles east of the city of Vancouver, B.C.

The site of the meadow was, no doubt, originally an arm of the sea, which has been filled up by sediment carried down by the Fraser River. Pitt River is a large, deep-water channel connecting Pitt Lake with the Fraser River. All are tidal waters, having a daily average rise and fall of about three feet.

During the flood season of the Fraser River the water is backed up over the meadows for a period of from two to two and a half months, in May, June and July, which made necessary the construction of a dike around the land to prevent its flooding, flood-gates to drain off the water at low tides, and a pumping plant to relieve it from the accumulated rainfall and seepage during the period of high water.



Dike prevents high water from backing up and overflowing meadows.

The land is a rich alluvial deposit with a depth of about 2 ft. of clay loam on the surface, under which is a depth of about 10 ft. of yellowish clay, and under this, in places, as much as 1,200 ft. of river silt and clay, ascertained by recent boring operations.

Reclamation Work

The reclamation work consisted principally of 11 miles of dike, with an average height of 10 ft., a set of flood-gates, and a pumping plant.

The dike was built a safe distance away from the river bank, on a carefully selected site, which was cleared of all timber, brush, roots, grass and rubbish. A key ditch was excavated and over it the embankment placed. This ditch extended down to the clay subsoil so that when the filling was placed puddle was formed under the dike that cut off the seepage.

The dike was constructed with dipper dredges, the material being taken from the land side in order to provide a ditch for drainage purposes, which was, in this case, a very important consideration; otherwise it probably would have been advisable to have taken the material from the outside.

The dike has a top width of 6 ft. and side slopes of 1½ horizontal to 1 vertical. Between the inside toe of the bank and the ditch is left a berm 6 ft. in width. The ditch averages about 35 ft. in width and 7 ft. in depth. The extra material required for low places was secured by widening the ditch instead of deepening it.

The adopted level for the top of the dike was fixed by the highest known water level of the Fraser River, which occurred in 1894. The finished top being 2 ft. above this level, gives it an average height above the land of about 10 ft.

Piles Driven to Retain Banks Across Two Deep Sloughs

Across two deep sloughs which intersect these meadows, the dike was constructed in a manner similar to the rest of the work, except that in addition to the earth bank, a quantity of brush and a row of closely driven piles were placed to retain the slopes and protect the dike against the wave action of the adjoining ponds.

One of these sloughs, known as Sturgeon Slough, extends through the central part of the meadows. It has a total length of about 3 miles, a width of from 100 to 150 ft. and a depth of about 20 ft. It was thought advisable to dike around this slough for a distance of one mile inland from its outlet, thereby keeping open a deep waterway into the central portion of the reclaimed land.

Along the portion of the dike adjoining Pitt Lake a protection banquette outside of the dike was constructed of surface soil and sods to protect the dike from the wave action of the lake and moving driftwood. This bank extends to within 3 to 4 ft. of the top of the dike, and has a width of from 12 to 15 ft., the material being placed by a dipper dredge operated during high water along the outside of the dike.

In addition to this protection work, fences were placed outside of it by all exposed points. These were built by driving cedar piles on 8-ft. centres, to which were spiked 1½-in. fir lumber, leaving 2-in. openings between the boards.

The flood-gates are located at a point near the crossing at Sturgeon Slough, this being the most central place available. They are directly connected with the slough channel, which acts as an equalizing reservoir about 35 acres in area, giving a quicker discharge than could otherwise be had if they were fed only from the ditch.

The flood sluiceway has four 5 x 8-ft. openings, and is constructed of reinforced concrete, except the floor, which is built of fir timber. As this floor will always be covered with water the timber will be durable and satisfactory and the cost much lower than for concrete. The gates are hung at a slight angle, and open and close automatically with the fall and rise of the tides.

Pumping Plant

The pumping plant is located near the flood-gates, and consists of one 30-in., double-suction, horizontal, centrifugal pump having two suction inlets, each 22 ins. in diameter at the pump, tapering to 24 ins. in diameter at the suction end. The 30-in. discharge pipe is also enlarged to 36 ins. where it passes through the dike.

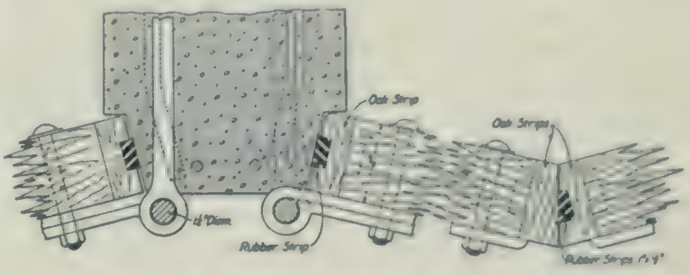
This pump is driven by a 100-h.p. Westinghouse motor, transmitting the power to the pump shaft through a Reynolds silent chain drive. It is set on a concrete foundation, resting on a group of piles, at a level sufficiently low to discharge under water at all stages during the flood period.

The maximum lift is 9 ft. and the capacity of the pump is 25,000 gals. a minute, which, estimated from all the available data, is sufficient to provide for the rainfall over the whole drainage area plus the seepage during the months mentioned.

The land was granted by the Dominion Government to the Pitt Meadows Land Company in the name of W. R. Rannie, at a nominal price per acre, and with the provision that the whole reclamation work would be completed before May, 1913. The work was performed, under contract, by Messrs. W. A. Rannie and J. W. Pile, of Vancouver, B. C., at a total cost of $109,000, or about $15 an acre.

The unit prices were: dikes, 14½ cents a cubic yard; dams, 24 cents a cubic yard; protection banquette, 10 cents per cubic yard; clearing, $50 per acre; grubbing, $75 an acre; piling in place, 25 cents a foot, and lumber in place, $24 per foot b.m.; flood-gates complete, $575; pumping station, $9,689.

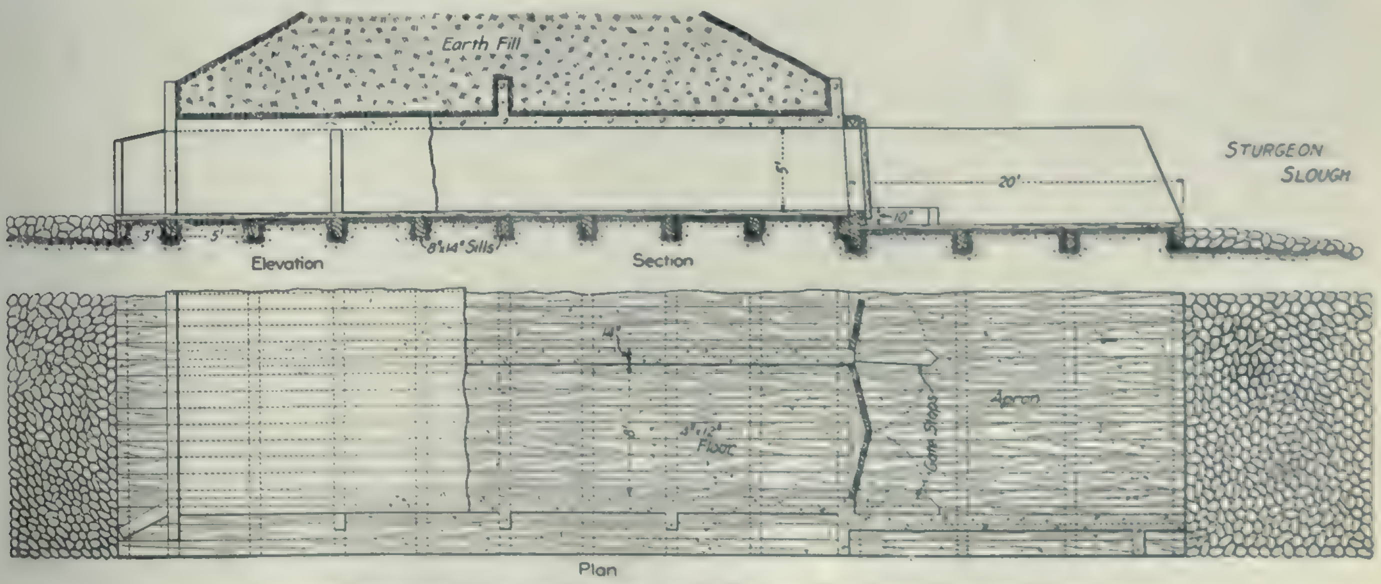
The whole work was performed under the direct supervision of Mr. H. M. Burwell, C.E. (Messrs. Hermon and Burwell, Vancouver), with Mr. H. St. J. Montizambert acting as assistant.



Flood gates open and close according to rise or fall of tide.

For the article and illustrations we are indebted to The Engineering Record, of New York City.

M. Jean de Pulligny, who gained a wide acquaintance in the United States while head of the French mission of engineers studying American engineering practice, was granted a two-months' leave of absence from the French army in order to represent his government at the International Engineering Congress, in San Francisco. At the beginning of the war M. de Pulligny rejoined his battalion, in which he had held the rank of major previous to his resignation several years ago, and was promptly assigned, with his former rank, to take charge of a road-building detail at the front. His command consisted of seven hundred men, with 235 horses and 20 motor trucks. Of the trucks some (steam-propelled) had a carrying capacity of 10 tons. On account of the heavy traffic in munitions and food supplies—carried largely by heavy motor trucks and trailers—the building and maintenance of the roads to the front and along the trenches is most important, and M. de Pulligny's command was occupied entirely with this work.



Sluiceway constructed of reinforced concrete, with timber floor, drains track at periods of low tide.

Noteworthy Accident at Canora, Sask.

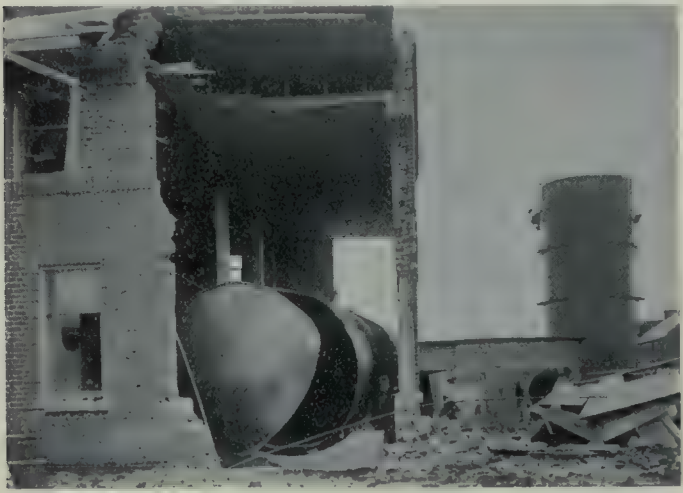
THE corporation of the town of Canora, Sask., suffered a loss on September 23rd which crippled their fire protection and did considerable damage to their town hall and power station.

About 6.40 p.m. the water storage tank which was located in that portion of the municipal building occupied by the electric light plant burst while being filled with water, the unfilled portion containing air under pressure.

The extent of the damage to the building and the tank itself are plainly shown in the accompanying photograph. In this photograph it can be seen that the tank was raised from its foundation and forced back about four feet.

While half a dozen rivets pulled through the metal of the shell, the remainder held, thus tearing a strip from the end of the shell through the centre of the rivet-holes.

The cause of the accident was found to be due to the relief valve having been badly corroded and the tension spring filled with rust. This valve was so placed that the waste or overflow from other pipes discharged over the top of it, thus causing the heavy corrosion. The pressure gauge, too, shows heavy corrosion, and is reported to have registered but forty pounds pressure to the square inch. The relief valve was set at one hundred pounds per square inch.


Damage to building and tank at Canora, Sask.

This tank, which is nine feet in diameter and thirty-eight feet long, formed a part of the Hoosier high pressure system, which was installed in 1912 for fire protection only. Similar systems have been installed for fire and domestic supply by the corporations of Yorkton, Wilkie, Melfort and Old Battleford, Sask.

The town of Canora now has under construction a more complete system of water-works designed by Messrs. Chipman and Power. This will be ready for initial test very shortly. The steel stand-pipe, which is being constructed for the new system, is shown in the background of the photograph.

Construction work on the new five-million-dollar Field Museum of Natural History, to be built in Chicago, has been begun. The structure will be completed, it is expected, in less than three years, and more than 3,000 men will be employed in the work. When finished it will be the largest marble building in the world. It will consist of three storeys and a basement, and will cover an area of 700 ft. by 350 ft. The floor area of the museum will be 670,000 square feet, of which 400,000 square feet will be devoted to exhibition purposes. The remainder will be used for scientific laboratories, lecture halls, offices, and a restaurant. The contract for the building is held by the Norcross Bros. Company, of New York and Worcester, Mass., and the material employed will be Georgia marble.

Utilizing Hydraulic Principles to Locate a Leak in a Submerged Pipe

THE detection and location of leaks in submerged pipe lines supplying islands or areas isolated from the main distribution system by rivers or channels is a problem in water-works operation requiring special treatment. Detection of leakage on such lines is comparatively simple, but the location of the same is an entirely different matter. Any of the usual means of measurement fitted for the size of main, with perhaps special arrangement for large mains, will determine the presence and size of leakage if simultaneous readings are taken on both sides of the stream.

Several points should be noted which have a bearing on the problem of leak location and which affect the method to be used for such location. Owing to the expense attached to the examination and repair of submerged pipes, it is not worth while to do anything with them unless the amount of water going to waste is worth more tahn the probable expense of making repairs, or unless the pressures in the area supplied are materially reduced, or serious damage is anticipated from a continuation of the leakage.

In general, the above considerations would limit the complete investigation to leaks of such size as would make applicable the following method which has been used in New York City on a 12-in. crossing from Rikers Island to North Brothers Island and is considered sufficiently successful to warrant making preparations for use on other river crossings.

Where the velocity of water in a main due to the leak is 2 ft. per second, a perfectly good gradient consisting of two distinct slopes can be obtained. At the point where the slope of gradient changes is the point where the velocity changes and hence where the waste occurs.

To determine this gradient it is necessary to have the pipe coefficient as accurately as possible, to have the quantity of the flow on the supply and the discharge ends of the submerged pipe, the pressures and elevations at which pressures were taken on both ends, and the distance between pressure points. Flow measurements and pressures ought to be taken simultaneously. Pressure gauges should be accurate and of such graduation as easily to estimate to tenths of pounds.

Locating Leak in 12-in. Line

The specific case of the above mentioned crossing between Rikers and North Brothers Island, New York City, will best illustrate the method.

Some time during the month of July, 1914, a decided drop in pressure on North Brothers Island was reported to the Department of Water Supply and an urgent request was made to have conditions improved. The district repair gang found after valve operation that the trouble was on the 12-in. crossing from Rikers Island to North Brothers Island, this stretch of pipe being a section of a loop from the mainland at Barretto Point to Rikers Island to North Brother Island and on through a 6-in. line to the mainland at 140th Street. Orders were issued to the Water Waste Division to determine, if possible, the location of the break, because North Brothers Island with its hospitals was under these conditions dependent upon the one inadequate 6-in. line. A party was sent out at once and carried through the investigation with satisfactory results in a couple of days.

As no pipe coefficient was available, it was necessary to determine one for a line of similar size and under similar conditions. It was obtained at Barretto Point on the Rikers Island line. With the valve closed on the North Brothers Island end of the broken line, a pitometer placed in the 12-in. line at Barretto Point measured the leakage plus the Rikers Island consumption, then closing the valve on the Rikers Island end of the broken main the island consumption alone was measured. The difference gave the leakage for that height of tide. As soon as possible, then, pressures were taken simultaneously on hydrants located near each end of the flexible submerged pipe. Hydrant elevations and distance were obtained by level and transit respectively, distance being checked roughly from a government chart. The co-efficient C in the Chezy formula, $v = C \sqrt{rs}$, was then determined for the Barretto Point section where a flow was constant throughout its length. Applying the pipe coefficient to the broken section, the slope of the gradient up to the leak was found. Since the valve at the North Brothers Island had been closed, there was no flow beyond the leak, hence a flat gradient obtained from the leak to that point. After figuring the gradient elevation at each hydrant and plotting the gradient to scale, the distance of the leak from the hydrant at North Brothers Island was determined as approximately 600 feet.

To check the figures an attempt was made to find the leak by sound. An engineer using an aquaphone with an oar placed in the water was taken in a boat and by means of stadia and transit was directed to the point near where the leak was supposed to be. The sound could be distinctly heard even though the depth of water was about 25 feet. On a circumference of 100 ft. radius, approximately, the sound became indistinct. As found by the diver, the break was 570 ft. instead of 600 ft.

It is possible, we believe, to locate such leaks at least as closely as within 30 feet and often closer if the pipe coefficient is accurately determined for each crossing and corrected every few years as the pipe ages.

These data are the abstract (by Engineering and Contracting) of a paper by Mr. Elmer G. Hooper, Assistant Engineer, Department of Water Supply, Gas and Electricity of New York City, before the New England Water-Works Association.

Smooth-break blasting of underwater concrete pillars was recently accomplished by one Bolger, a South Carolina blaster, according to the October issue of the "Du Pont Magazine." Some 3-ft. iron-incased concrete pillars, 24 ft. long, 8 ft. under water and 8 ft. in mud and sand, were to be cut down level with the mud bottom. The first attempt was by shooting holes drilled in three sides, but this gave a jagged surface. Then a cloth pocket about 2 in. wide was filled with dynamite and wrapped around the column at the proper level. After the charge was fired the break was found as clean as though the concrete had been sawn.

Standardisation, and the Metric and Decimal System*

ONE of the favourite jibes at this country is our supposed utter want of system in regard to our standards and systems of measurement generally. With regard, for instance, to the decimal system, it is frequently stated that thirty or forty countries have adopted the metric system, while only three retain the inch as a standard. It must be remembered, however, that the population and wealth of the three latter are at least equal to, if not greater than, all the others, though this does not really prove anything, except the difficulty of the subject, and that there is a great deal to be said for both sides. In the report of the Decimal Association last April the hope is expressed that one of the changes for the better arising from the war will be a reform of our weights and measures. No class of the community would be affected more closely than the engineer, and engineers cannot fail to be interested in the question as to whether the general and immediate adoption of the metric system would or would not be a valuable means of assisting British firms in their competition with Germany and Austria in countries where that system is in vogue. Although it is very unlikely that a wholesale change is imminent, it is certain that the metric system is gradually spreading, and in the United States and Australia very strong forces are on foot to bring about a change to that system. The British Association has over and over again had the subject before it, and our committee might be of service in making a report on the present state of the matter.

One thing is certain: the Committee might be of assistance in recommendations which would bring into line all British engineers in duplicating tenders for countries which have the metric system.

Coming to standardization, here we have more ground for satisfaction. The Engineering Standards Committee during the last ten years has done a work which is quite equal to that in any other country of completing standardization of all important matters in engineering, and, moreover, has secured the recognition of these standards in all public contracts. As giving some indication of the range of this work, it may be said that there are more than sixty committees for dealing with every conceivable engineering matter, from bridges, ships, and locomotives, down to electric lamps.

There is yet work to be done. One matter of great importance would be to get a universal standard of temperature for instruments of measurement other than zero. A temperature, for instance, of about 62 deg. F. would make steel rods' measures more practically workable than at present.

In connection with the subject of temperature and standardization, I recently came across a statement by the General Secretary of the International Electrotechnical Commission that the want of uniformity in the rating and testing of electrical machinery has been a serious evil, and he goes on to say: "The German standardization rules, for instance, which, through well-organized and combined effort on the part of the German makers, had, previous to the war, become widely recognized on the Continent of Europe, as well as in many countries to which British machinery is exported, by permitting a higher tempera-

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[*] Extract from an address delivered in London by Prof. H.S. Hele Shaw before the Engineering Section of the British Association.

ture rise than is considered good technical practice in Great Britain, certainlv have not assisted the British maker in foreign markets.

Tunnel Driven Under Inclined Railway with Thin Earth Cover

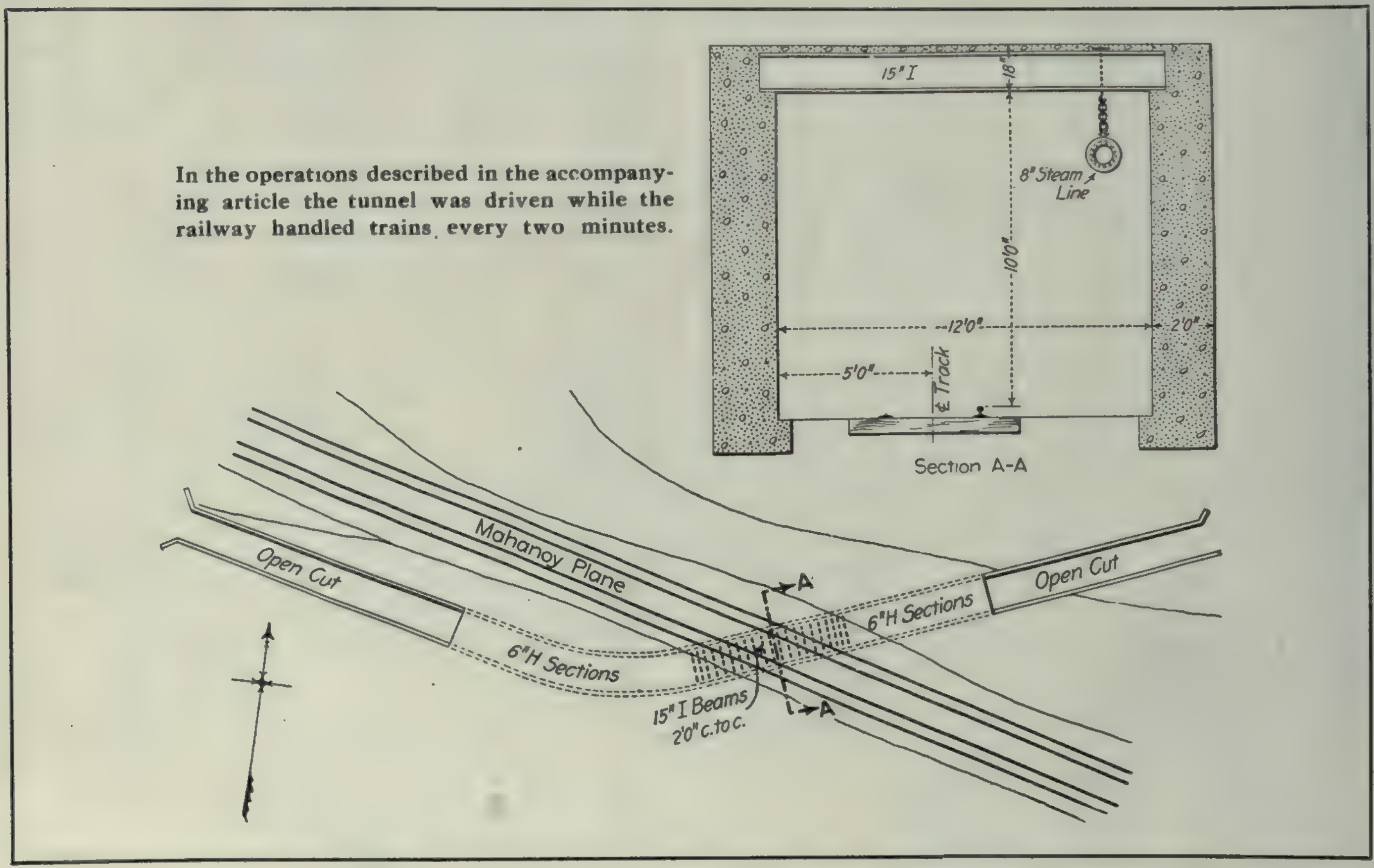
A TUNNEL, driven with thin earth cover under an inclined railway which carried heavy traffic, has recently been completed at Frackville, Pa. The work, which has very interesting features, is described by The Engineering Record.

The inclined railway is known as the Mahanoy Plane. The tunnel was designed for the purpose of hauling coal to the breaker in the operation of the Maderia Hill Coal Company's mine. The plane under which the tunnel is driven is a double-track cable hoist about 4,000 feet long, having an average grade of about 10 per cent. The Philadelphia & Reading Railway uses it to hoist its coal from the Mahanoy Valley to the top of Broad Mountain from where it is taken down the Schuylkill Valley to the Philadelphia market.

The Maderia Hill Company planned to mine coal on both sides of the plane, and was building a large breaker on the east side. In order to bring coal from the west side to the breaker the company had either to construct an overhead crossing or to drive a tunnel. The plane was operated by an engineer from a tower at its head. The construction of an overhead bridge would obstruct his view, and consequently the idea of the bridge was abandoned.

The tunnel section is rectangular, 16 ft. wide and 13 ft. high in outside dimensions, the roof being made of I-beams encased in concrete. The centre line of tunnel crossed the plane on an acute angle, consequently the distance from the roof of the tunnel to the rail of the plane varied from 20 ft. on the east side to 11 ft. on the west side. The material between the roof of the tunnel and the plane consisted of clay and gravel. This material was very difficult to undermine, both because of its nature and because of the continuous pounding of the traffic on the plane, on which four 50-ton coal cars crossed the tunnel every two minutes. The cross-section of the tunnel took in about one-third clay and gravel, one-third the Little Buck Mountain vein of coal, and one-third the underlying rock, all pitched on an angle of about 60 degs. The rock occupied one corner of the section all the way through.

All materials were furnished by the mining company. For upright timbers 14-in. yellow pine was used. For collars 6-in. yellow pine was tried, but found too weak, and 16-in. oak was substituted. Directly under the plane where the impact was worst centre props were placed under the collars until the I-beams were set. The tunnel was driven from both ends, taking out the full section without any advance heading except what was necessary in driving the fore poles ahead. The timbers were spaced every 3 ft. The mode of procedure, once the timbering was fairly under way, was to drive fore poles ahead and take out a bench about 3 ft. deep and 6 ft. high, placing the collar and bracing it. Next the excavation was made for the low-side leg, which was usually in the vein of coal. The rock on the high side was then drilled for the collar or for a short leg if the rock was not high enough for the collar to rest on directly. The rest of the material was then removed by blasting and shoveling. One-yard rolling dump cars pulled by mules were used for removing the muck. The drill-



In the operations described in the accompanying article the tunnel was driven while the railway handled trains every two minutes.

ing was done with two jack-hammers supplied with air from a company compressor installed near the tunnel portal.

The concrete work followed up the timbering as fast as possible, being started as soon as the headings reached the plane. Concrete was placed in about 20-ft. sections, and kept about 20 ft. behind the heading. This was done in order to make the span supported by timbers as small as possible to reduce the risk of a cave-in. Concrete materials were delivered by the plane, but because of the steep slope and the short space between the ends of the tunnel and the sides of the place it was not thought advisable to set up a mixer and spout concrete through the roof. Consequently the concrete materials were unloaded from the plane (during dinner hour) and then shovelled through a chute in the roof of the tunnel to a mixing platform inside. Here the concrete was mixed by hand and shoveled directly into the wall forms and the roof. Thus, the concreting did not interfere with driving the tunnel, except for some slight damage done to the forms by blasting.

The work was carried on at the rate of 3 ft. a day, and a night shift was used about half the time. The cost of tunneling, the timber, track and power being supplied by the mining company, was $3.24 per cubic yard or $74.85 a linear yard. The concrete, for which materials were supplied by the mining company, cost $2.11 per cubic yard. It cost $0.0013 a pound to place the steel I-beams with their sheet-iron arches.

Road Foundation and Drainage

By Geo. W. Cooley†

MOST foundation troubles are caused by difficulty of drainage. Although the value of proper drainage is admitted by all, it is a fact that road engineers and superintendents will in many cases fail to provide for the elaborate drainage necessary to a proper foundation, for the reason that funds are limited, and expensive drainage work reduces the amount of available funds for providing a suitable surfacing. This applies particularly to the great mileage of main rural roads.

So much has been written on the subject of road foundations that the whole field of investigation has apparently been covered, but in any work of construction there may appear some detail or condition for which there is no precedent and which must be met by the ingenuity or ability of the engineer or superintendent in charge. As such problems are generally encountered on the improvement of county and local roads, and are apparently of such minor importance that the information is not published or disseminated, a better general knowledge of this work can be obtained by a meeting at least once a year of those in charge of road work throughout each State. It is the lack of attention to details of drainage and foundation work which causes much of the failure of road surfaces, and the relating of experience at a meeting of those actually in charge of work, with technical advice from proper authorities, would go a long way toward securing more permanent construction.

We hear a great deal about permanent road work, meaning particularly the different kinds of road surfaces, but experience has taught that the most important part of road construction is the foundation, and that the adequacy of the foundation controls to a great extent the life of the pavement or surface.

Road Drainage a Necessity

The drainage of a road must be complete. While the cost of carrying water away from the side ditches of a road often seems prohibitive, the expense is always warranted in the better construction obtained. When impossible to provide complete drainage, the elevation of subgrade of the road should be at least 2½ feet above possible high-water.

In the middle west surface drainage will generally suffice, and a proper design of road section in such cases requires gutters from 1½ to 2½ feet below subgrade, the variation depending upon the character of the soil. Gutters on grades exceeding five per cent. should be paved, and in any case water should not be carried in road gutters further than is absolutely necessary.

In providing for cross drainage, only permanent substantial material, such as concrete, should be used, for the failure of a cross culvert will not only block the drainage, but will damage the road surface, and may cause accidents.

In heavy soil which appears to be saturated, or in which there is seepage, it is advisable to place drain tile. The tile should be so laid that they will intercept the ground water, and it is frequently necessary to place a line at each side of the road with leaders or branch lines from the centre of road at fifty-foot intervals. This construction is required on side hills which develop springy conditions. Rock-filled drains are also used successfully on side hill work, but are not so efficient as tiling on account of their liability to become partially clogged by sand deposits.

In undeveloped swamp country the most permanent work is obtained by building the embankment from excavation of a dredge ditch on the upper side of the road with an auxiliary road ditch on the lower side. When swamps have soundings of from two to five feet the grade line of dredge ditch may be disregarded, excepting as to minimum depth.

On construction of swamp roads the top soil is spread first and then sufficient firm material is excavated to provide a substantial foundation. These ditches are dug with practically vertical sides in order to secure the maximum amount of firm material from bottom, and are of sufficient size to allow for necessary drainage after breaking down of slopes. The low points in ditch, where deeper excavation is required to secure material, will fill with sediment after a year or two. It sometimes appears extravagant to make such large ditches on road work, but in new country lateral drainage is always carried to the road ditches, and should be provided for in advance. There is not much difference in cost, however, between hand ditches and a large dredge ditch, on account of the lower unit cost of machine work.

Preparing the Foundation Properly

After drainage is secured, the important points in road foundations are to eliminate all vegetable or perishable matter, and to build up the foundation uniformly. Dragging and planing the subgrade as it is being built will prevent the waviness of surface which develops occasionally after completion of a road, and it is advisable to place such requirement in the specifications.

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† Engineer, State Highway Commission of Minnesota, St. Paul.

Surfacing with gravel constitutes the greater portion of rural road work, and a great deal of money is wasted in not properly preparing the foundation for this surface. Common practice has allowed the placing of gravel to a depth of from six to eight inches, on clay or heavy soil, frequently on a newly shaped roadbed. Until compacted, this coat of gravel serves as a sponge, holding the water until the subgrade is softened, thereby allowing the material to be cut through and much gravel to be lost, with consequent rutted and uneven condition of surface.

Foundations for gravelling should be firm and hard. On new work this may be accomplished by forming a crust with a mixture of two or three inches of sand or gravel with clay subsoil, rolled to a smooth surface. On sand subsoil it is equally necessary to have a foundation in order to prevent loss of gravel, and in such cases clay mixture is required.

To prevent loss of surfacing gravel on sand subgrade, where no clay is available, a blanket of vegetable material has been used with complete success. In some cases this has been provided by spreading about four inches of loose straw for the full width of proposed surfacing, but care must be exercised to prevent the straw from mixing with gravel. Muskeg or pulverized peat has also been used to advantage under like conditions.

Foundations for Higher-Type Surfaces

The foundation for higher types of road surfacing, such as concrete, requires even more attention than for gravel, or macadam roadways. The material must not only be firm, with adequate provision for drainage, but the subgrade must be thoroughly drained out before pavement is placed. Most of the cracking and failure of concrete roads has been due to moisture in the subgrade at the time frost sets in, and this has frequently occurred where tiling was laid and the road built in the latter part of the season.

The success of any road is dependent upon the complete drainage and uniformity of material in the subgrade or foundation, and it would seem that road authorities could well afford to devote some attention to educating the public along this line, for a knowledge of the necessity of such work is required to secure public support, without which the work cannot proceed intelligently or economically.

The old church of St. Paul's, Halifax, N. S., is a standing testimony to the durability of timber. This ancient pile, which dates from 1750, is constructed of pine and oak which was brought from Boston, Mass., which in those early days was part of the British Empire. It is the mother church of the Church of England in America and has frequently been termed "The Westminster Abbey of Canada." It is very rich in historical associations. It was built on the "Parade" in 1750 at the expense of the Crown, by grants from His Majesty George II. and also by moneys granted to the King for the use of Government. The interior of the church built of wood contains a great wealth of mural tablets of greater historical interest than can probably be found in any other church on this side of the Atlantic.

Use of Large Stone Chips in the Maintenance of Bituminous Roads

THE Maryland Highway Commission, of which Mr. Henry G. Shirley is Chief Engineer, after an experience with the maintenance of bituminous roads extending over several years, has adopted the practice of using stone chips at least 1 in. in size. The chips are spread over the surface of the road, at seasons of the year when the bitumin is soft, in an even layer one stone thick and rolled. The rolling forces the stones into the surface of the road until they are flush with the pavement. When completed the surface has somewhat the appearance of a mosaic. Hard blue limestone is used, and has been found to be quite satisfactory for this purpose.

The reason for the method of maintenance adopted by Mr. Shirley is obvious. It has been universally found in practice that small stone chips are either quickly ground to a powder by iron-shod traffic or are in a large measure swept from the road surface by automobile traffic. The use of sand is now quite generally avoided by maintenance engineers on the ground that it tends to build a mat or pad that becomes unmanageable when thick, and also greatly increases the danger of waves in the pavement due to the pushing of the bituminous surface occasioned by the continual passage of automobiles usually travelling in a single direction on one side of the road.

While this method of surface maintenance, or more properly termed surface improvement, is not new from an experimental standpoint—similar work having been done by Mr. Crosby, the former engineer for the commission—its application to road maintenance work on a large scale, such as is in progress in Maryland, is an innovation. From the standpoint of the road user it possesses advantages. The exposed stones roughen the surface and reduce the slipperiness of the pavement. Slipperiness has always been a fault of bituminous treated country roads, especially since many of the horses that travel them are not sharp shod. The danger of automobile skidding is also reduced. From the standpoint of increasing the life of the road the reduction in slipperiness permits the use of a relatively higher crown, thereby insuring thorough drainage of the surface and increasing the durability of the road, the practice of most road engineers being to use as much crown as limiting conditions will permit. In this connection it may be said that experience has demonstrated in the city of Washington that asphalt streets and roads built with a high crown have usually a longer life than those streets or roads on which less crown is used.

While the labor cost of applying large stone chips in this manner is necessarily increased somewhat, the road surface is improved by the thorough ironing out it is given by the roller. The greater availability of the supply of larger stone is also a factor worthy of consideration in many sections of the country. It is frequently difficult to secure an adequate supply of ½-in. and ¾-in. stone.

One of the latest improvements in the vicinity of the Pennsylvania Railroad Terminal in New York City is a massive building to be named after William Caxton, the first man to introduce printing in England in 1476. The building will be twelve storeys high. Each floor of the new structure will have a rentable floor space of 11,500 sq. ft., with a lithographer's studio on the roof.

The Street System in City Planning[*]

By Nelson P. Lewis[†]

THERE have been a few cases where important cities have been planned as a unit; where the administrative centre, the commercial, industrial and residential districts, the lines of transportation and their terminals, have been laid out after careful study to meet conditions which could be confidently expected or to a large degree controlled. Washington is one of the most notable instances of such city planning. The city planner usually finds, however, that the beginning has already been made, a beginning which may prove a serious handicap or may, though less frequently, be an admirable nucleus for the larger plan. Most old cities have simply grown with very little planning. Comprehensive plans, where such have been prepared, are of comparatively recent date and have had to adapt themselves as well as might be to the older portions of the towns as they were, and make designs for sections not yet developed conform with the haphazard growth which had already taken place. Plans of such cities, therefore, commonly consist of a number of separate designs more or less unrelated to each other, abutting upon the confused and uneconomic system of streets in the old town, which in most cases has persisted as the actual centre.

Streets in Undeveloped Sections

In every city, however, there are large areas not yet developed and not even planned, where opportunities are presented to design a street system, the different parts of which will be properly located with respect to each other and to such modification of the system of the existing town as may ultimately be carried into effect. Too often these undeveloped sections are planned as if they were so many different urban areas unrelated to each other or to the original city, and too often the obvious blunders of the older sections are repeated in the new additions.

In nearly all cases where a street plan is to be devised, whether it be for a large area which can be treated almost as an entire city in itself, or for a smaller tract contiguous to the built-up portion of an important city, the first essential is an accurate plan of the existing roads showing their widths and the buildings fronting upon them. The old highways which serve to connect villages or centres of population have a good excuse for existence and serve a useful purpose; they lead where people want to go and are likely to be fairly direct. Their alignment may be somewhat faulty, their grades excessive in some places, and their widths inadequate in view of the fact that they will naturally become the main lines of traffic for the urban district which will include them. With such straightening and widening as may be deemed necessary and such changes in line as will reduce excessive grades, these old roads will be the logical basis of the street plan which is to be prepared. When they have been platted, it will be obvious that additional roads will be needed, some to establish cross connections, others to give greater directness to the roads traversing the entire territory, others as bypasses around groups of buildings so located as to render the widening of some portions of the old roads unduly expensive, and still others to furnish lines of main drainage along the valleys through which the lateral sewers and subsidiary trunks must ultimately find their outlets.

While no one can predict with any certainty the precise manner in which any city will grow, the purpose of the preliminary design is to establish lines of least resistance which future development is quite likely to follow. The streets laid down in the plan will probably become the main arteries of traffic. They will divide the territory into a series of irregular figures having three, four or more sides, which sides may be a quarter or a half a mile or more in length. These areas must be subdivided by secondary roads in the location of which regard should be paid wherever possible to property subdivision, to the possibility of some of them developing into main traffic roads, and to the avoidance of awkward junctions with the main roads already laid down, which would result in confusion of traffic. It is difficult to say how wide the primary and secondary roads should be made. The Royal Commission on London Traffic in its report, made some years ago after an exhaustive study, suggested the following widths: Main avenues 140 ft., first-class arterial streets 100 ft., second-class arterial streets 80 ft., third-class streets 60 ft., fourth-class streets 40 to 60 ft. This scale of widths may be somewhat over-generous and might involve unnecessarily great cost.

Lastly will come the minor streets which will serve almost entirely for access to dwellings. Their alignment and grades are of little importance. The chief concern is that they should be so laid out as to furnish ample light and air and discourage, if not prevent, a too intensive development with rear buildings in case the city ordnances do not prohibit this menace to health and decent living. To plan far in advance the precise location of these minor streets is not necessary, if it be not unwise. There is no reason why a street which is to be devoted to private residences should be long and straight. Among the most attractive features of a city are small residential areas treated in a distinctive way, each with a character of its own, which the visitor stumbles upon with agreeable surprise. If these minor subdivisions are planned at different times or by different persons, this variety in treatment is more likely to be realized. The important thing is that the skeleton should be created first.

While directness is desirable in the main and even the secondary streets, it does not follow that such streets should be perfectly straight; in fact, straight streets are seldom interesting. Neither need circumferential or curved streets be laid out with perfect symmetry. In studying a plan the slightest departure from symmetry is noticeable, but on the ground it cannot be detected. One can ride or walk along a boulevard following a sweeping curve and be unconscious of the fact that its radius is frequently changing.

A concrete aqueduct constructed 200 B.C. at Tarragona, Spain, is described by a contemporary. This structure is 22 miles long, and portions are carried on viaducts. At one point the viaduct is 123 ft. high and consists of two tiers of arches of 22-ft. 6-in. span. Stone, brick and concrete were used in the structure, and broken bricks were used as aggregate for portions of the concrete. Little remains of the waterway, but some parts of the supporting structure are remarkably well preserved. The Spanish Government is taking steps to protect the structure.

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[*] Abstract of a paper presented last month before the International Engineering Congress at San Francisco.

[†] Chief Engineer, Board of Estimates and Apportionment, New York City.

Explosives Loosen Hard Ground for Driving Concrete Piles

By the use of explosives to break up hard ground concrete piles have been driven in the Philippines where other conditions called for a pile bridge, but where the ground would not ordinarily allow piles to be driven. Frank P. James, writing in the Quarterly Bulletin of the Bureau of Public Works of the Islands, tells how he employed this method on the Cabugao Bridge, Ilocos Fur.

The strata encountered included gravel compacted with sand and clay and carrying boulders up to 10 in. in diameter. From experiments on another bridge, where black powder had been used to loosen stiff clay for the same purpose, it had been determined that the ground was broken up about down to the bottom of the charge placed to make way for the piles. As nearly 20 ft. penetration was required on the piles on the Cabugao bridge, the explosive cartridges used were placed so that their lower ends were about 19 ft. below surface. There were five piles in a bent, and three shots were necessary for each bent, one each at the location of the two end and the centre piles.

Method of Charging Ground

The charges were placed by driving down a 3-in. diameter galvanized length of pipe about 20 ft. long. A coupling was placed on the driving end of the pipe, and the lower end was fitted with a cap which remained in the ground. One cap was required for each hole. These caps were made of pieces of old steel plate ½ in. thick and 7 in. square. The plates were notched deeply on their four sides, and the corners thus left bent up to fit around the end of the pipe. A hole was punched in the centre of each plate through which a 2-in. piece of ¾-in. round steel was driven, while the plate was hot, to form a point and guide the pipe in driving. The charge for each shot was loaded in a 2½-in. diameter tin tube about 39 in. long, in the bottom of which was tamped about 28 in. of powder. Above this were loaded two exploder sticks of dynamite, which was required to set off the type of powder used, and around these sticks was packed the contents of a third broken stick. Each of the exploder sticks had a cap and fuse of its own, to insure detonation. Above these were put more powder and a wad of thin paper such as is used to wrap rolls of fuse. The whole was sealed with asphalt or white lead, and the end of the tube was crimped slightly.

When the 3-in. pipe had been driven to the required grade, the charge was dropped to the bottom of it, and a 1-in. pipe was lowered around two fuses. The 3-in. pipe was then pulled about 6 ft. by a rope running to the engine of the driver, allowing dirt to run in around the cartridge. The 1-in. pipe was then withdrawn, and the 3-in. pipe pulled all the way out. One of the fuses was cut about a foot longer than the other to insure safety in lighting, which was done with a torch.

After the three holes for each bent were fired, the concrete piles were driven. Very satisfactory results as to grade were obtained, a few inches remaining below the disturbed ground in every case after the shot into which the tip of the pile could be driven. The bearing power developed exceeded the requirements.

According to the Neuste Nachrichten, of Munich, the enemies of Germany are greatly deceived if they think the German march into Russia is likely to encounter anything like the same difficulties as that of Napoleon. True, says this journal, the Russians have destroyed the railways, but in place of these the Germans have improvised light railways, which spring up like magic on the line of march. Then there are the giant automobiles, of which 2,000 are plying between the Vistula and the Bug alone. The number of draught horses provided, too, is so enormous that where the roads are bad four and even six can be harnessed to a load which two would be expected to draw in ordinary places. For crossing the rivers—presumably the smaller ones—the Germans, adds the Munich paper, are provided with portable trestle bridges.

New Gutters on Slate Roofs

A contributor to the Building World writes as follows with reference to the insertion of new gutters to slated roofs.

"When it is required to insert a new gutter to a slated roof it is often necessary to remove the lower two or three rows of slates to allow for the lead or other gutter material to be inserted. As the slating nails are covered up by the slates, it is not possible to extract the nails unless the slates above are removed. For the purpose of removing the nails the slater uses a 'ripper,' which has a thin blade and is inserted between the slates, and a slotted end allows for the clipping hold of the nails. A sharp tap on the ripper shears the nails and allows for the removal of the slates.

The replacing of the slates after the gutter has been placed in position presents a little difficulty. If one row of slates, which includes the double eaves course, has been removed it will be found that the eaves course can be nailed at the sides of each slate, and when the next course of slates is in position the nails will be covered. The course over the eaves course cannot be nailed, and is fixed by means of narrow strips of lead or zinc, which are nailed to the boarding through the small space left between each slate. The ends of these strips are turned over, and when the slate is inserted under the slates, the turned-up end clips the slate and prevents it sliding down the roof. If two rows of slates are necessary to be removed it will be found that the bottom row, comprising the eaves course and the slates immediately over, can be nailed, and the next row will have to be fixed as before mentioned. As regards the fixing of a parapet, or any other gutter, it depends upon the form of gutter used, and the construction of the roof at eaves, whether it is necessary to remove the slates or not. A good job usually requires the insertion of the gutter or lead apron under the slates. It is sometimes possible to insert an iron trough gutter under the slates without removal, but difficulty arises on fixing the gutter to the timber work. If the eaves project a good distance over the side of the gutter, or over the edge of the boarding or tilting fillet, it will be just sufficient if the side of the gutter is carried to the under side of the slates. If the gutter is deep, and a lead apron is used, the apron may be tucked under the slating and securely fixed to the side of the pole plate or other timber."

As an example of the saving effected by using the Panama Canal route, it is figured that the steamer Penrith Castle, on a voyage from Seattle, Wash., to Liverpool, England, saved 23 days. This, at $230 a day, and deducting for canal expenses and tolls, left a net saving of $1,188.

Mainly Constructional

East and West—From Coast to Coast

A contract for the construction of asphalt and concrete roads has been awarded to J. Toussaint and Company, Ltd., Montreal, by the Council of Montreal South.

The building permits issued in Toronto for the nine months' period ending September 30th amounted to $4,225,000. Five hundred permits issued last month represented the expenditure of $519,000.

It is stated that officials of the Dominion Steel Corporation were in Ottawa last week in connection with an unusually large contract for munitions. Arrangements for the contract are said to have been practically completed.

A new Walkerville firm is the Canadian Duplex Steam Trap Company, Limited, which has been incorporated with a capital stock of $40,000. The incorporators include J. H. Mailhot, T. G. Rakestraw, and A. M. Lamar—all of Detroit.

The Elora White Lime Company, Limited, has been incorporated with a capital of $100,000. The incorporators include H. W. Shapley, W. B. Milliken, and F. Lane—all of Toronto. The head office of the concern is to be at Elora.

In this column last week it was stated that negotiations had been practically completed for the purchase by the Russian Government from the Canadian Car and Foundry Company of fifty-two million shrapnel and high-explosive shells at a cost of fifty-two million dollars. This is obviously a typographical error: the number of shells should have been three millions.

At a meeting of the York Township Council last week there was submitted a report on the proposed water-main on Eglinton Avenue and the 12-inch main leading off to St. Clair Avenue, the total cost of which is estimated at $750,000. The Deputy Reeve, Mr. W. M. Graham, stated that if everything proved satisfactory to the city of Toronto and the township of York the work would be started in the spring.

The Acting Chief Engineer of Montreal, Mr. Mercier, has recommended the construction of a large sewer connecting all the sewer openings at Back River, thus carrying the sewage to a point where a purification plant could be erected, and the entire sewage treated. Owing to the want of this plant a sewer which cost $500,000 is at present useless, as the Provincial Board of Health has objected to the sewage being deposited into the Bank River in an unpurified condition from this and other sewers. To meet this objection six purification plants would have to be constructed, unless a connecting sewer and central plant were built, as suggested by Mr. Mercier.

In connection with the remodelling and extension of the waterworks of the City of Hull, P. Q., the E. Laurie Company, Montreal, have secured a contract for two De Laval pumps, each of 8 million gallons per day capacity, to operate against a total head of 140 feet. Each pump will be direct connected to a Canadian Westinghouse 325 h.p. slip ring type motor. Including the piping, the contract will total about $11,500. The E. Laurie Company are installing two vertical sewage ejectors of the "Chicago" type in the sewage system now being constructed at Chambly Basin, P. Q. One ejector is of 600,000 gallons capacity, and the other of 400,000 gallons capacity, complete with piping, wiring, &c. In addition, the company will furnish sewer flushing syphons of the "Miller" type to the town of Chambly. An order for a 12-in. De Laval single stage double suction pump, arranged for belt drive, for the St. Lawrence Pulp and Lumber Corporation, Chandler, P. Q., has been placed with the E Laurie Company.

Mr. R. N. Arkley, Sherbrooke, P. Q., is just completing for the Two Miles Water Power Company, a hydro-electric development on the St. Francis River, at Weedon, P. Q. The power house is of reinforced concrete, the water wheels being set in an open flume of reinforced concrete. The turbines were supplied by the William Hamilton Company, of Peterborough, and the generator by the Canadian General Electric Company. A transmission line is also being completed, to furnish current to the copper and asbestos mines in the district. The company will materially benefit from the construction of the new dam on the St. Francis River by the Quebec Streams Commission. Mr. M. A. Sammett and Messrs. Surveyer and Frigon, Montreal, were the consulting engineers.

Messrs. Ouimet & Lesage, civil engineers, 76 St. Gabriel Street, Montreal, have designed a sewage system for St. Agathe des Monts, P. Q., at an estimated cost of $125,000. Sewers will be constructed, with house connections, salt glazed vitrified pipe being used. The system is divided into three sections. Under two of them the sewage will gravitate into two pumping stations, from where it will be pumped into the third section. The sewage will then flow by gravity into the purification tank, hypochloride of lime being fed into the tank. When purified, the sewage will be carried by gravity into the North River. In the pumping stations two centrifugal pumps will be installed, these being operated by motors. Current will be supplied from the municipal power plant, the current being stepped down from 2,300 v. to 550 v. or 220 v.

The sum of rather more than a million dollars has been expended this year by the Harbour Board in furtherance of its development scheme. The Government's estimated expenditure on its share of the work—which is mostly pile-driving—was also placed at one million dollars, but this has been cut down considerably owing to certain delays. In the first year $1,500,000 was spent jointly by the Government and the Commission. In all, forty-five acres of land have been reclaimed at the Humber end of the work, 600,000 cubic yards of sand having been pumped in. At the extreme east end of the work, where Ashbridge's Bay is being converted from a swamp into a first-class factory district, nearly two million cubic yards of sand have been pumped in during the past season. The bridge which is being built over the Don channel at the foot of Cherry Street as a permanent part of the harbour construction, at a cost of $105,000, will be completed early in the spring.

THE citizens of Oshawa, Ont., have voted in favor of a by-law in favor of a company which plans to spend two million dollars upon the erection of a plant and give employment to some 1,500 workers. The town will give a site of 140 acres and guarantee bonds to the amount of $60,000, in return for which the company will spend $350,000 on the plant before the end of 1916. Mr. David Maxwell, of Traders' Bank Building, Toronto, is identified with the concern.

Can we Increase the Volume of Engineering and Building Operations in Winter? See p. 1049 of this issue, and let us hear from you.

Personal Mention

Mr. W. M. Treadgold, Town Engineer of Brampton, Ont., is among those who qualified for a Captain's certificate at the examinations conducted recently at Niagara-on-the-Lake.

Mr. J. W. Astley, formerly Engineer of Construction for the city of Winnipeg, will be a candidate for the Board of Control at the forthcoming elections in the western metropolis.

William Walters, a Toronto contractor, who was recently appointed Inspector of Harbour Improvements in that city, died of appendicitis at Lindsay last week.

Mr. Charles A. Millar, of Toronto, President of Price's, Limited, and Vice-President of the Price-Cummings Company, both brick manufacturing concerns, has been appointed Inspector for the Clay Products Safety Association in connection with the administration of the Workmen's Compensation Act.

Mr. Chas. A. Millar, of Toronto, who has been appointed Inspector for the Clay Products Safety Association.

Lieut. P. W. Greene, formerly on the engineering staff of the Sun Brick Company, Limited, Toronto, is serving with the 35th Battalion, which is under orders to proceed to England.

Mr. Joseph Keele, of the Dominion Geological Survey, was the guest of honour at a dinner given recently in Toronto by the executive of the Canadian National Clay Products Association on the occasion of his return to Ottawa.

A booklet on "Refractory Efficiency Engineering," received from the Elk Fire Brick Company of Canada, Limited, Hamilton, Ont., contains a general outline of the manufacture of all kinds of fire brick, and shows why it is to the interests of the consumer that the engineering phase be given more attention than it has received in the past. A brief description is given of the manufacture of fire brick, from the mining of the clay to the selling and loading of the products. A part of the booklet is devoted to the products of the Elk Fire Brick Company. This firm was organized in 1901, and the following year built its first plant with the small capacity of one car a day. Since that time the original plant has been increased to six cars a day, and in addition the company has purchased additional clay lands, and now has in operation three complete plants having a combined capacity of fourteen cars a day.

Engineers Visit B. C. Plants

In acceptance of an invitation extended by the Victoria and Vancouver Branches of the Canadian Society of Civil Engineers, a party of sixty-five engineers who had attended the International Convention of Civil Engineers at San Francisco decided to return east via the Canadian Pacific Railway scenic route and thus make it possible to become the guests of the B. C. engineers and inspect some of the important works with which they had been associated.

The visitors were met at Seattle by Mr. R. W. McIntyre, Secretary of the Victoria Branch, and on their arrival at Victoria next day they were welcomed by Mr. D. O. Lewis (Chairman of the Victoria Branch), Mr. F. C. Gamble (President of the Canadian Society of Civil Engineers), Mr. C. H. Rust (City Engineer of Victoria, and Past President of the Canadian Society), and others, who escorted them to the Empress Hotel, where rooms had been engaged. In the afternoon the visiting engineers and their ladies were taken by motor to the Gonzales Observatory and later to the extensive plant of the Vancouver Portland Cement Company at Tod Inlet, which was fully inspected, after which refreshments were served at the residence of the Manager, Mr. H. P. Butchart. In the evening the visitors were extended a welcome by Premier McBride and the Hon. Thomas Taylor, Minister of Works, at the Parliament Buildings, which were fully illuminated for the occasion.

Boarding the night boat, the delegates were met at Vancouver next morning by Mr. G. R. G. Conway, President of the Vancouver Branch, General Manager Kidd—of the British Columbia Electric Railway, and others, who escorted the party to the Hotel Vancouver. The day was devoted to sight-seeing trips and a tour along the waterfront. On Wednesday the visitors became the guests of the British Columbia Electric Railway Company on a trip to the power plants at Lake Buntzen, the steamer Bowena being chartered for the day. On arrival at the works the visitors inspected No. 1 and No. 2 power houses and a number braved the trying climb up the mountain side in order to view the entrance to the long tunnel connecting Lakes Buntzen and Coquitlam.

A trip to the plant of the Western Canada Power Company at Stave Lake had been planned for Thursday, but as the visiting engineers were anxious to inspect the new tunnel at Rogers Pass on their way east this part of the programme had to be abandoned.

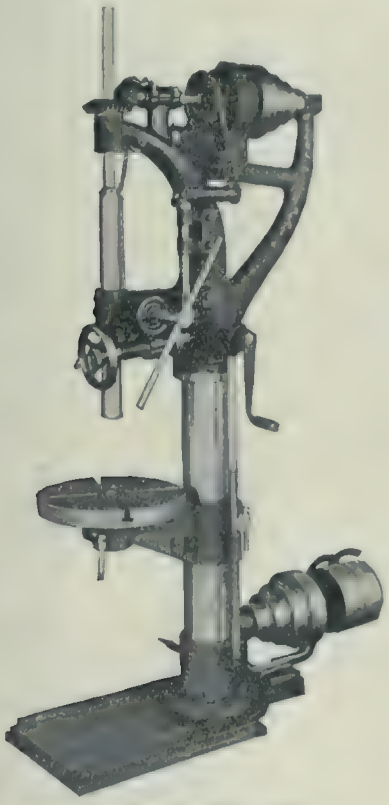
Among the visiting engineers the most prominent was Mr. A. Rohm, Professor of the Federal Politechnique School, Zurich, Switzerland, who was the delegate of the Swiss Confederation. Other prominent engineers were Mr. A. Stuckie, President of the A. Stuckie Company, of Pittsburg, Pa., and Mr. Emmett B. Carter, Chief Engineer of the Midvale Steel Company, of Philadelphia, one of the largest steel concerns in the United States.

The visitors expressed themselves as greatly delighted with their trip, and were enthusiastic in their appreciation of the scenic beauties of Victoria and Vancouver.

A unique and attractive exhibit at the Canadian National Exhibition in Toronto last month was a Union Jack, six feet by four feet, shown by the Canadian "Pyrofugont" Flooring Company, Limited. The flag was of asbestos fibre composition, made exactly true to the original, in indestructible colours. The subfloor of the flag was one-half inch thick, and was laid in the same way as a floor. The Canadian "Pyrofugont" Flooring Company have laid over one-half million square feet in Canada, and more than fifteen million square feet in Europe. Recent contracts total upwards of 300,000 square feet. The firm's head office and works are at Berlin. Mr. J. E. Klotz is Secretary-Treasurer, and Mr. C. Ide Manager.

Canadian 20-in. Drills Adapted for High Explosive Shells

At the plant of the Canadian Blower & Forge Company, Berlin, Ont., the Canadian 20-in. drill has been adapted for all of the lighter operations in place of the heavier type of machines. The drill is giving especially good service on sizing the threads. On the British 18 pr. high explosive shell, there is a thread 1¼ in. long on the inside, 2 in. diameter No. 14 Whitworth gauge right hand. This thread must be accurately sized with a variation of not more than .002. The Canadian 20-in. drill is doing this work with perfect accuracy, cutting a clean thread. At the same time it is equipped with a milling cutter which re-seats the bevelled surface at the end of the shell on which the fuse rests. This seat must fit perfectly to pass inspection, so that there will not be any space whatever at any part of the circumference between the timing fuse and the shell. The inspection on this point is rigid, and the Canadian 20-in. drill does the work perfectly at the rate of 20 an hour tapped and reseated, or 30 an hour tapping alone.



The Canadian 20-in. drill.

For reaming the sides and finishing the bottom a modification of the standard 20-in. Canadian drill has been made. The automatic power feed-travel-spindle has been increased to 14½ in. and is controlled throughout its travel by an automatic trip, which can be tripped for any pre-determined depth. The tripping mechanism which is on the hand lever shaft is new and does away with the customary spindle-sleeve clamp type of trip. This arrangement permits a length of automatic feed equal to the full travel of the spindle, the usual automatic speed on ordinary drills being three to four inches shorter than the spindle shell. The single feed of .030 of an inch per revolution of the spindle for this particular drill is positive and is obtained through two sprockets and a linked chain. Three step cones can be substituted at any time for the chain drive, and speeds of .004 to .007 and .012 of an inch can be obtained. The drill has hand, lever and automatic feeds, so that any condition of feed can be met.

The crown gear runs in a bronze bushing which can be renewed without trouble, thereby eliminating the bother and expense of rebabbitting—with the chance of getting the spindle out of alignment. The drill spindle has a No. 4 Morse taper, and the key drift slot is below the sleeve, so that the key drift can be used with spindle in any position. The greatest distance from the spindle nose to the table is 20½ in., and from the nose to the base, 36½ in. This arrangement for a long feed makes it possible to use a comparatively small and moderate-priced machine on the work of a large and expensive one.

A Federal Labour Bureau System

Contributed by E. St. John Wileman

THE unemployment of the last three years is bringing home to the Dominion that, in common with other countries, Canadians must face the evil squarely, and apply remedies which will not merely touch the surface but will provide a bedrock foundation for the permanent removal of injurious conditions.

One of the principal reforms which has been tested by a variety of nations and has emerged successfully from the trial is that of National Labour Exchange systems, which date their first appearance from 1865. The support accorded during the last four years to the movement for securing a national system has extended from Prince Rupert to Halifax, and has given municipalities, Boards of Trade, Labour Unions, Builders' Exchanges, the Churches, and National Societies the opportunity for publicly recording their opinions. Last session saw further testimony in the shape of petitions presented to the Commons and Senate by eight of the principal towns, asking for immediate legislation. The system stands for economy, efficiency, and reliability: it provides a continuous national register of the employable and the unemployable; it directs the former to openings in work and assists to control it; it puts the latter into immediate touch with relief agencies. Other functions of the system are briefly: (1) providing a national regular bulletin of industrial fluctuations and seasonal or abnormal crises; (2) securing the co-ordination of municipal, state and federal authorities in dealing with lack of employment and providing necessary occupation.

Everyone now realizes the usefulness of a Federal Weather Bureau, and the time will come when the Industrial Labour Bureau will be still more valued.

The failure of the Minister of Labour to keep the official pledge made to a large deputation at the Parliament Buildings on May 18th, 1914, that a Bill establishing the system would be carried through Session 1915 (the Measure is non-contentious and had the support of the Liberal party), is extremely unfortunate in view of the situation to be faced this winter in all the towns of the Dominion and of problems of acute complexity to be dealt with after the war.

It is to be hoped that thinking men will bestir themselves before next session, to bring home to the Government the necessity of keeping the pledge and passing the legislation without delay.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Brockville, Ont.
A number of changes have been made in the plans for the proposed filtration plant, and new tenders will be called. Engineer, G. W. Bryson.

Chatham, Ont.
The Board of Works intend to lay a sewer on Beattie Street. City Engineer, F. P. Adams.

London, Ont.
The Board of Control will receive tenders until 10 a.m., October 15th, for the construction of about 2,700 feet of 8-inch sanitary sewer with private connections. Plans, etc., at office of the Engineer, H. A. Brazier.

Tenders on laying a sewer on Inkerman Street will be received by the Board of Control until October 22nd. Plans and specifications with the Engineer.

North Vancouver, B.C.
The Municipal Council have been granted permission by the City of Vancouver to tap their watermain on Seymour Street in order to supply Keith Road and Indian River Drive. A 2-inch pipe line will be installed. Engineer, A. M. West.

Peterborough, Ont.
The City Council have decided to lay sewers on Robinson, Victoria and Aylmer Streets by day labor under supervision of Engineer R. H. Parsons.

St. Andrews, N.B.
The Town Council are negotiating with the Canadian Pacific Railway Company, Montreal, for a water supply. The enlargement of the Town's system is estimated to cost between $20,000 and $30,000. Clerk, E. S. Polleys.

Thorold, Ont.
The Town Council are considering the construction of sewers on a number of streets. Engineer, J. F. Henderson.

Waterloo, Ont.
The Town Council have authorized the laying of sewers and concrete sidewalks on various streets, and have passed a by-law providing for the construction of three filter beds. Clerk, J. C. Haight.

Winnipeg, Man.
The Board of Control propose to grade a portion of Spruce Street this Fall. Secretary, M. Peterson.

York Township, Ont.
The Township Council will call for tenders shortly on the construction of pavements on Lauder and Glenholme Avenues. Estimated cost, $8,000. Engineer, F. Barber, 57 Adelaide Street E., Toronto.

CONTRACTS AWARDED

Essex, Ont.
The Town Council have let the contract for the construction of concrete sidewalks to John Wortley.

London, Ont.
The contract for laying asphalt pavement and gravel roadway on Elmwood Avenue for the City Council has been let to the Standard Paving Company, Central Chambers, Ottawa, at $2.28 per square yard.

Roxborough Township, Ont.
The Township Council have let the contract for the construction of the Munro Drain to J. A. Valade, Cornwall, Ont., at $7,204, and the Monklands Drain to Joseph Cameron, Berwick, Ont., at $2,700.

West Vancouver, B.C.
The general contract for the construction of a waterworks system for the Municipal Council has been let to the Cotton Company, Limited, 1830 Granville Street. Work includes a reservoir, with a capacity of 300,000 gallons, and a 6-inch pipe line to the city.

Windsor, Ont.
The City Council have let the contract for laying concrete pavement and curbs on Cataraqui Street to Cadwell Sand & Gravel Company, 84 Sandwich Street. Approximate cost, $4,500.

Railroads, Bridges and Wharves

Burlington, Ont.
The tenders submitted for the construction of the Martha Street Bridge are not satisfactory, and the Town Council have decided upon a different type of construction. Tenders will be called as soon as specifications are prepared. Clerk, James S. Allen.

Port Stanley, Ont.
The Port Stanley Railway Commission are considering the construction of a stone promenade pier next spring. Secretary, Major Spittal, People's Loan Company Building, London.

Public Buildings, Churches and Schools

Beaton, Ont.
The Grand Jury have recommended to the Simcoe County Council that an addition be erected at the County House of Refuge, as the men's quarters are overcrowded. Clerk, R. J. Fletcher, Barrie.

Fitch Bay, Que.
The erection of a school next spring is being considered by the School Commissioners. Secretary, L. E. Carpenter, Smith's Mills, Que. Estimated cost, $3,000.

Midway, B.C.
Tenders on the erection of a school will be received until noon, October 19th, by J. E. Griffith, Deputy Minister of Public Works, Victoria. Plans and specifications at offices of W. R. Dewdney, Government Agent, Greenwood, R. D. Kerr, Secretary to the School Board, Midway, and at the Department.

Ottawa, Ont.
The Public School Board are considering the erection of an addition to the Creighton Street School. Work will probably commence early next year. Chairman, D. M. Chambers.

The Ottawa Collegiate Institute are considering the purchase and remodelling of the old Ladies' College building on Albert Street. Secretary, Cecil Bethune, Central Chambers.

Port Credit, Ont.
The contracts for the erection of the proposed school have not been awarded, as the Village Council have refused to provide funds. Secretary to the School Board, A. Block.

St. Honore, Que.
The congregation of the Parish are considering the erection of a frame church. Curate, J. B. Martel.

Stelcam, Sask.
Tenders on the erection of a school and shed are being received by W. F. Cradock, Secretary to the School Board, Stelcam. Plans, etc., with Secretary.

Toronto, Ont.
The Raymond Construction Company, Limited, 104 Howard Street, Toronto, are receiving tenders on all trades required in the erection of the Booth Memorial Home, Davisville, for the Salvation Army. Architect, Brigadier G. Miller, Salvation Army Property Department, Adelaide Street, Toronto. Reinforced concrete, structural steel and brick construction. Approximate cost, $150,000.

The Board of Education will receive tenders until 4 p.m., October 15th, for the erection of a school containing 37 rooms, and estimated to cost $200,000. Plans and specifications at office of the Superintendent of Buildings, City Hall. Structural steel and brick construction, stone trim, fireproof floors.

CONTRACTS AWARDED

Cardston, Alta.
The contract for heating in connection with the school now in course of erection has been let to Frank Summerton, Cardston. Remainder of work will be done by general contractor.

Shawinigan Falls, Que.
In connection with the school now being built for the Roman Catholic School Commissioners, the contract for plumbing and heating has been awarded to Richard & Bergeron, Fourth Avenue.

Waterford, N.S.
In connection with the church being built for the congregation of St. Agnes Parish, the contract for plumbing has been let to Wilmot Guthro, Alexander Street, Glace Bay, and the plastering to William Farrell.

Business Buildings and Industrial Plants

Blenheim, Ont.
E. W. Knight is building his garage by day labor, and is in the market for a store front and quantity of glass.

Cobourg, Ont.
The erection of a picture theatre, estimated to cost $20,000, will be started next spring. W. L. Stewart, proprietor of the Princess Theatre, London, is interested in the project.

Hamilton, Ont.
The Royal Hamilton Yacht Club have appointed a Committee to consider the question of rebuilding their Club House. Secretary to the Club, H. McPhie.

Montreal, Que.
David Sirois, 145 Hamilton Street, has commenced the erection of a store and residence, estimated to cost $5,000.

With regard to the restaurant being built at 480 St. Catherine Street West, K. G. Rea, 59 Beaver Hall Hill, was wrongly reported in our last issue as being one of the contractors. Mr. Rea is Architect for the owners.

Mount Brydges, Ont.
The Crow Auto Company are building their factory by day labor. Material is being purchased by R. H. Bellamy, Box 134, Mount Brydges.

Ottawa, Ont.
The erection of a garage is being considered by Theodore Landrey, 315 Rideau Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $6,000.

Port Moody, B.C.
The Port Moody Steel Works, Ltd., propose to erect a steel plant and rolling mills, and a by-law to guarantee their debentures to the extent of $100,000 will shortly be voted on. Town Clerk, George Bolt.

Port Stanley, Ont.
The Utilities Commission are considering the erection of a pavilion in connection with the new electric railway. Work to commence in the Spring. General Manager, E. V. Buchanan, City Hall, London.

St. Johns, Que.
C. Pontre is building a barn and stables by day labor. Estimated cost, $4,000.

Thorold, Ont.
All work in connection with alterations now being carried out at the Grand Trunk Railway Station will be done by the Company. Frame construction. Approximate cost, $4,500.

Zurich, Ont.
F. Hess, Sr., is about to erect an implement shop, estimated to cost $3,000. White brick construction, felt and gravel roofing.

CONTRACTS AWARDED

Chatham, Ont.
The contract for concrete work at the Rennie Seed Company's plant has been awarded to B. Blonde, 14 Cornhill St., Chatham.

Ford City, Ont.
The contract for the supply and installation of metallic window sash and frames at the addition to the Ford factory has been let to the Trussed Concrete Steel Company, Walker Road, Walkerville.

Hamilton, Ont.
The general contract for alterations to the Y. M. C. A. Building on James St. S. has been awarded to John Vogan, 280 Sandford Avenue N. Estimated cost, $19,000.

Milton, Ont.
In connection with the Registry Office erected for the County of Halton, the contract for painting has been let to the general contractors, P. H. Secord & Son, Limited, Brantford, Ont. Electrical work not let.

Montreal, Que.
In connection with the hotel to be erected on St. Catherine Street E. for T. Bastien, 5 Beaver Hall Square, the carpentry contract has been let to the general contractor, F. A. Grothe, 6 Cuthbert Street, and the contract for concrete, steel and masonry to the Atlas Construction Company, Limited, Belmont Street.

Orillia, Ont.
The contract for concrete work in connection with the store to be built on Mississaga Street by T. B. Cramp, P. O. Box 516, has been awarded to F. Woodrow. Brick construction, concrete foundation, paroid roofing.

Ottawa, Ont.
The following contracts have been let in connection with the stores being built at Bank Street and Third Avenue by John Sutherland, 216 Cooper Street: cornices, etc., McFarlane & Douglas, Slater Street; plastering, John Sutherland, 510 Rideau Street; painting, W. J. Carson, 293 Laurier Avenue W.; electrical work, E. G. Tressider, 58 Fifth Avenue. Interior fittings by owner.

The general contract for the erection of a storage building for the Ketchum Company, Limited, Sparks Street, has been let to Joseph Dionne, 77 Redpath Street. Ironclad construction, concrete foundation, corrugated iron roofing. Approximate cost, $3,000.

The contract for electrical work at the store erected on Bank Street by W. H. Lister et al has been let to H. R. Welch, Second Avenue. Plastering not yet awarded.

Port Lambton, Ont.
James Ansel has let the contract for the erection of a garage to Joseph Reedy. Frame construction, concrete foundation, shingle roofing. Estimated cost, $3,200.

Quebec, Que.
The contract for heating at the greenhouse being built on Dauphine Street for the Department of Public Works, Quebec, has been let to Jobin & Paquet, Abraham Hill.

Toronto, Ont.
The contract for heating and plumbing at the branch which has been erected at Dupont and Christie Streets for the Merchants Bank has been let to Sheppard & Abbott, 78 Harbord Street.

Work has been started on the erection of an office for the Toronto Harbor Commission, 50 Bay Street. Brick construction, felt and gravel roofing. Approximate cost, $8,000.

Walkerville, Ont.
In connection with the lodge hall and store in course of erection for the I. O. O. F. and E. H. Gregory, 127½ Windermere Road, the carpentry contract has been let to John Scott, 34 Parent Avenue, Windsor, the roofing to Thomas Blackburn, 54 Pitt Street E., Windsor, and plastering, painting and electrical work to J. Reid, 158 Goyeau Street, Windsor.

Waterloo, Ont.
Work is about to start on the erection of a garage and warehouse for the Water and Light Commission. The masonry has been let to Ellert Bros., Park Avenue, and carpentry to Reitzel Bros., Allan Street.

Westmount, Que.
In connection with the bakery being built for Dent Harrison, 323 Prince Albert Avenue, the contract for mill work and carpentry has been let to McRobert & Gibeau, 10 Benoit Street, Montreal. Heating not yet awarded.

Residences

Hamilton, Ont.
Plans have been drawn for a residence to bt built on Fairleigh Crescent by Ellison & Jones, 21 Senator Avenue. Brick construction, stone foundation, shingle roofing. Plastering by day labor. Approximate cost, $3,500.

London, Ont.
Plans are being prepared for a number of residences to be built next spring by the Copp Syndicate,—Secretary, A. M. Hunt, Dominion Savings Building. Foundations will be laid this fall. Red pressed brick construction, concrete foundation, slate and shingle roofing. Approximate cost, $3,000 each.

Montreal, Que.
N. Peloquin, 335 Harvard Street, has commenced the erection of two residences and garages on Harvard Street, estimated to cost $5,000. Tenders will be called for heating, plumbing and electrical work. Brick construction, concrete foundation.

M. Hayman, 35 Royal Street, contemplates the erection of a residence on Melrose Street, estimated to cost $5,000. Brick construction, felt and gravel roofing.

Mount Brydges, Ont.
W. Campbell has commenced the erection of a frame residence, estimated to cost $3,000. Concrete foundation, shingle roofing.

The erection of a residence has been commenced by James Bond. Frame construction, shingle roofing. Estimated cost, $3,000.

Archibald Lamont is preparing plans of a residence estimated to cost $3,200.

Ottawa, Ont.
Work on the erection of a double residence on Frank Street has been started by T. J. Somerville, 28 Waverly Street. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $5,000.

Quebec, Que.
Quotations on all materials required at the residence now being built on Bourlamarque Street are being received by Ernest Rochette, 40 Des Stigmates Street.

Smith's Falls, Ont.
M. G. Henniger, 12 Mary Street, is building a residence on Brockville St. Stone and cement construction, shingle and asbestos roofing. Estimated cost, $10,000.

St. Catharines, Ont.
Building Inspector F. W. Barley has recommended that a new residence be built for the Cementery Superintendent at an approximate cost of $3,500. City Clerk, J. W. Pay.

Thorold, Ont.
Beverly Johnstone is building two residences on York Street. Frame construction.

Work has been started by J. Berhalter on the erection of a residence on Queen Street, estimated to cost $3,000. Frame construction.

Toronto, Ont.
J. M. Vaughan, 32 Summerhill Gardens, has commenced the erection of a birch residence at 14 Wightman Street, estimated to cost $6,000. Smaller trades will be let.

The Board of Control will receive tenders until October 19th, for the installation of sanitary conveniences in a number of houses. Plans at office of the Health Department, City Hall.

Donnenfeld Bros., 322 Clinton Street, have commenced the erection of a residence at 69 Dixon Avenue. Brick construction, shingle roofing. Approximate cost, $3,000. Smaller trades will be let.

CONTRACTS AWARDED

Hamilton, Ont.
F. N. Beck, 477 Cannon Street E., has let the general and masonry contracts for the erection of a residence at 104 Barnsdale Street S. to Smith Bros., 20 Norway Avenue, and the plastering to Chapman & Son, 69 Hughson Street. Owner will do carpentry, roofing and painting. Brick construction, stone foundation, shingle roofing. Estimated cost, $3,200.

Lakeside, Que.
Work has been started on the erection of a residence for C. W. MacLean, c/o Robert Findlay, Architect, 10 Phillips Place. The brickwork, masonry and concrete work will be done by John Quinlan & Company, 4412 St. Catherine Street, Westmount. Other contracts will be awarded shortly by Mr. Findlay. Approximate cost, $12,000.

London, Ont.
The following contracts have been let for the erection of apartments on Maple Street for William Bernard, 401 Wellington Street:—general contract, Sanderson & Robson, 289 Oxford Street; brick work, John Moran, care of general contractors; mill work, Dyment-Baker Lumber Company, 309 Bathurst Street; plumbing and heating, Hunt Plumbing Company, 533 Richmond Street; plastering, J. Fenn, 752 William Street; painting and glazing, Lewis Bros., 179 Mill Street; mill work and wiring, J. A. Page, 807 Dundas Street.

Montreal, Que.
J. E. Belanger, 1225 Cote des Neiges Road, Montreal, has commenced the erection of a residence for The Greater Montreal Land Investment Company, 313 Quebec Bank Building. Brick construction, felt and gravel roofing. Estimated cost, $3,000.

Mount Brydges, Ont.
Longfield Bros. have commenced the erection of a residence for Arden Sutherland. Red pressed brick construction, stone and concrete foundation, slate and shingle roofing. Approximate cost, $3,500.

Niagara Falls, Ont.
Clark Bradley, 63 St. Clair Avenue, has let the general, masonry, carpentry, steel, roofing, plastering and painting contracts for the erection of a residence to John Humphries, 48 Ellis Street. Brick and frame construction, shingle roofing. Approximate cost, $4,000.

Quebec, Que.
G. Cantin has started work on the erection of a residence on Lee Street, estimated to cost $5,000. The masonry contract has been let to P. Tardif, 260 Napoleon Street, and the roofing to O. Barbeau, 154 Franklin Street.

In connection with the residence being built on Aberdeen Street by East & Masson, 62 St. Nazaire Street, the contract for masonry has been awarded to P. Tardif, 260 Napoleon Street. Carpentry will be done by owners.

The carpentry contract in connection with the residence in course of erection for L. F. Burroughs, 147 Maple Avenue, has been let to E. Cantin, 8 Conroy St. Other trades not yet awarded.

In connection with the residence being erected for Jules Gingras, 203 St. Oliver Street, the masonry contract has been let to H. Dallaire, 68 Sixth Street, Limoilou, and the carpentry to the general contractor, A. Darveau, 152 Latourelle Street.

The contract for masonry at the residence being built on Abraham Hill for H. Pare, 18 d'Youville Street, has been let to J. B. Verre & Son, Limoilou, and the carpentry to V. Talbot, 92 Morin Street.

The contract for painting at the residence built on Aberdeen Street by Lavoie & Frere, 56 Jeanne d'Arc Street, has been let to A. S. Bedard, 116 Des Stigmates Street.

The general contract for the erection of a residence on Fourth Avenue, Limoilou, for E. Lemieux, 26 Joseph Street, has been let to E. Baril, 18 St. Albert Street, Limoilou. Frame and brick construction, concrete foundation, metal roofing. Estimated cost, $4,000.

Smith's Falls, Ont.
Work is progressing on the erection of a curling rink for the Smith's Falls Curling Association. General contractor, John Davidson, Herbert and Annabella Streets. Cement and brick construction. Approximate cost, $7,000.

Thorold, Ont.
Work has been started on the erection of two frame residences on Queen St. for Mrs. M. Smith, Buffalo, N. Y. General contractors, Swinton & Heysel, Thorold. Estimated cost, $4,500.

Toronto, Ont.
In connection with the residence built at Lauder and Regal Avenues by W. Connery, 410 Manning Chambers, the painting contract has been let to W. A. Putland, 101 Conduit Street.

The plastering contract in connection with the residence erected at 62 St. Andrews Gardens by A. R. Doherty, 56 St. Andrews Gardens, has been let to J. Linbow, 496 Manning Avenue.

Work has been started on the erection of a garage on Davenport Road for James I. Scott, 145 Dupont Street. The masonry, concrete and carpentry contracts have been let to Teagle & Son, 310 Davenport Road. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,000.

Vancouver, B. C.
Glover Lloyd, 1999-19 Avenue W., has commenced the erection of a residence for E. W. McLean, 1638 Angus Avenue.

Westmount, Que.
The general contract for the erection of a residence on Carleton Avenue for H. Pike, Victoria Avenue, has been let to Anglins Ltd., 65 Victoria Street, Montreal. Brick construction, concrete foundation, slate roofing. Approximate cost, $10,000.

Anglins Ltd., 65 Victoria Street, Montreal, have commenced the erection of two residences at Grosvenor and Westmount Streets for H. Beaudry, Sherbrooke Street E. Brick construction, concrete foundation, slate, felt and gravel roofing. Estimated cost, $20,000.

Power Plants, Electricity and Telephones

Brantford Township, Ont.
The Reeve has been authorized by the Township Council to sign an agreement with the Hydro-Electric Commission for the supply of power for street lighting and private purposes.

Elma Township, Ont.
The installation of a Hydro Electric distribution system is contemplated by the Township Council. Reeve, William Scott, Atwood, Ont.

Port Stanley, Ont.
The Port Stanley Railway Board are preparing plans for an ornamental lighting system to be installed along the beach and on the Heights. Work will start shortly. Secretary, Major Spittal, People's Loan Company.

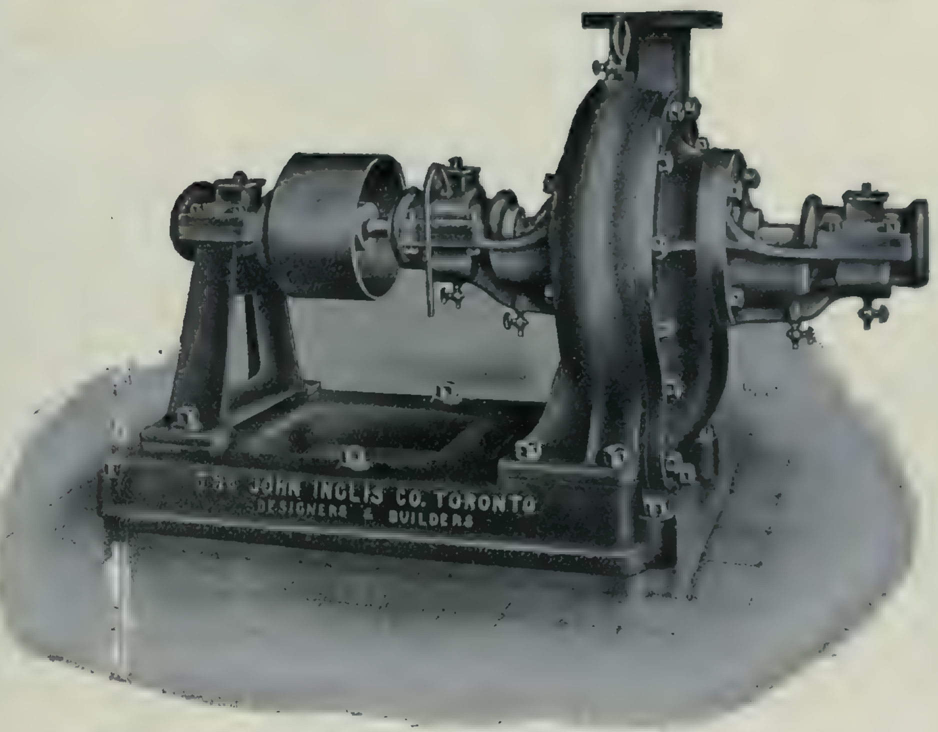
St. Lambert, Que.
The Town Engineer, E. Drinkwater, will receive tenders until 6 p.m., October 16th, for the installation of 42 lamp standards with about 6,500 feet of duplex underground wiring cable. Plans with Engineer.

CONTRACTS AWARDED

London, Ont.
The City Council have awarded the contract for the supply of transformers to the Canadian Moloney Company, c/o E. V. Buchanan, City Hall.

Saskatchewan Province
The Kent Rural Telephone Company have let the contract for the construction of their system to E. S. Channell, 108 Clarence Avenue, Saskatoon. Approximate cost, $2,500.

PUMPS



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THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

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The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

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Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Fires

Brighton, Ont.
Farm buildings belonging to Isaac Richards have been destroyed by fire. Loss exceeds $8,000.

Cooksville, Ont.
The pool room and store owned by Frank and Charles Harris has been entirely destroyed by fire.

Galt, Ont.
Fire has destroyed a barn on the Clyde Road, belonging to D. and A. Little. Loss between $3,000 and $4,000.

Kincardine, Ont.
Fire has destroyed the frame residence of Miss Robinson, Princess Street.

Parrsboro, N. S.
Fire has destroyed a barn owned by John Duffy.

Puslinch, Ont.
Stephen Laidley's barn has been destroyed by fire. Loss is partially covered by insurance.

Rodney, Ont.
The garage, livery stable and barns belonging to John McCarter, Stinson Street, have been entirely destroyed by fire. Loss, $5,000.

Ryerson, Sask.
Fire has destroyed the elevator belonging to the Saskatchewan Co-operative Elevator Company, Ltd., New Leader Building, Regina. Loss, $8,500.

South Maitland, N.S.
Fire has destroyed a store owned by the Atlantic Rubber Company and the residence of Mrs. John Allen. Loss partly covered by insurance.

St. Jerome, Que.
The hotel owned by A. Gravel, St. Louis Street, has been destroyed by fire. Loss, $18,000. Building will be replaced by a brick and stone structure.

Miscellaneous

Glace Bay, N. S.
D. J. McIsaac, Victoria Street, desires prices, catalogues and other information with regard to brick, cement, glass, hot water boilers, steam boilers and hot air furnaces.

Kingston, Ont.
Davis & Son, Ltd., are in the market for one Wheelock engine, 125-150 h.p., one 100 k.w., a.c. generator, 550 volts, 60 cycles, three-phase, and one 100 k.w., d.c. generator, 550 volts, 60 cycle, three-phase.

Mitchell, Ont.
The Town Council are in the market for a large quantity of hard field stone. Clerk, William Ryan.

Niagara Falls, Ont.
W. P. Gonder, Culp Street, is in the market for turning machinery to the value of about $1,000.

Ottawa, Ont.
Thomas McLaughlin, 574 Somerset Street, is in the market for a clam-shell bucket.

Owen Sound, Ont.
The Canadian Malleable Iron Company, Third Avenue, and the Owen Sound Iron Works Company, 1175 First Avenue E., are about to equip their plants for the manufacture of 60-pound high explosive shells.

Peterborough, Ont.
Ephgrave & Barrett, 615 Union Street, desire prices, catalogues and other information with respect to structural steel, coping tile, screens, vault doors, weather strips, fire escapes, steel bars for concrete reinforcement, skylights.

Quebec, Que.
Prices, catalogues and other information with regard to the following supplies are desired by Joseph Breton, 175 Olivier Street:—brick, cement, steel, glass, spruce and pine planks and boards.

Windsor, Ont.
Tenders will be received until October 19th by W. H. Hanrahan, Secretary to the City Council, for the supply and installation of one 200 h.p. Scotch boiler, 16 feet 3 inches in length. Specifications at office of the Secretary.

CONTRACTS AWARDED

Dover Township, Ont.
The Township Council have let the contract for dredging at the Terry Mechanical Pumping Works to the Chatham Dredging Company, c/o W. G. McGeorge, 153 Queen Street, Chatham, at $3,750, and the pumping contract to Park Bros., 165 William Street, Chatham, at $3,250. Contracts for bridges, 18-inch glazed tile pipe and team work not yet awarded.

St. Laurent, Que.
Beattie Bros., Ltd., Fergus, Ont., have been awarded the contract for the supply and installation of steel stable fittings at the Grey Nun's barn, now being erected by the Atlas Construction Company, Montreal, Que.

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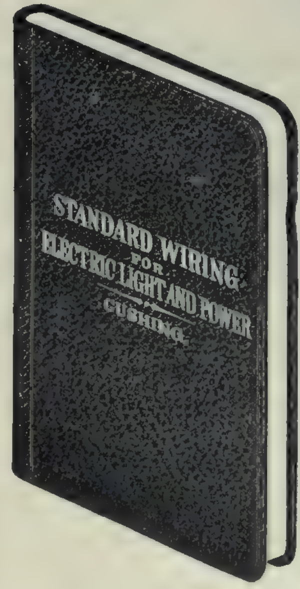

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Tenders and For Sale Department

Tenders for Construction of Pavement

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, October 18th, 1915**, for the construction of asphalt pavements on Lauder Avenue and Glenholme Avenue, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, October 12th, 1915. 41

CITY OF BERLIN
(Province of Ontario)

Pumping Machinery

Sealed tenders will be received by the Chairman of the Sewerage Committee until twelve o'clock noon on **Tusday, October 26th, 1915**, for furnishing and installing sewage pumping machinery, comprising:—

(a) Two Turbine Pumps and all piping, capacity 500 gallons per minute, 33 feet head.

(b) Two A.C. Motors, Switchboard and Electrical Instruments, installed complete.

Specifications may be seen at the Engineer's Office, City Hall, Berlin, or at the office of the Consulting Engineers, 204 Mail Building, Toronto.

The lowest or any tender not necessarily accepted.

HERBERT JOHNSTON, Esq.,
City Engineer.
A. H. MILLAR, Esq., City Clerk.
JOHN HESSENAUER, Esq.,
Chairman, Sewerage Committee.
CHIPMAN & POWER,
41 Consulting Engineers.

Tenders for Boiler

Sealed tenders, addressed to J. F. Smythe, Esq., Chairman Water Commissioners, Windsor, Ont., and marked "Tender," will be received by the undersigned up to 12 noon on **Saturday, October 23rd**, for the building and installing at the Windsor Water Works Pumping Station of one 200 h.p. Steel Scotch Boiler—to carry 160 lbs. pressure according to specifications and blue prints on file at the office of the Water Commissioners, City Hall, Windsor, Ont.

The boiler must be registered for the desired pressure in the Province of Ontario, and proper Government Certificate furnished before final payment is made.

Each tender must be accompanied by a certified cheque payable to the order of the Water Commissioners, Windsor, Ont., equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited, if the person or firm whose tender has been accepted decline to enter into a contract when called upon to do so, or fails to complete the contract.

If the tender be not accepted the cheque will be returned.

The right is reserved to reject any or all tenders; or to accept any tender.

The Water Commissioners,
W. A. Hanrahan, Secretary.
Windsor, Ont., Oct. 7th, 1915. 41-42

Tenders for Construction of Concrete Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, October 18th, 1915**, for the construction of concrete sidewalks on Earlsdale Avenue, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Township Engineer.
Toronto, October 12th, 1915. 41

Concrete Machinery For Sale

Three Concrete Mixers, twelve Concrete Hand Dump Carts, two "Beatty" Hoists for sale at sacrifice price. Apply F. C. Creed, 903 Read Building, Montreal. 40-41

Engineer desires to represent manufacturers, Montreal and district, on commission. Box 378, Contract Record, Montreal.
41-42

Late News Items

Montreal, Que.
J. H. Demers, 627 Marquette Street, has commenced the erection of twelve flats, estimated to cost about $15,000. All work will be done by day labor.

Montreal South, Que.
The Municipal Council have let the contract for laying asphalt and concrete roads to J. Toussaint & Company, Ltd., 2743 St. Hubert Street, Montreal. Approximate cost, $21,000.

New Glasgow, N. S.
The Town Council are considering the laying of a temporary 8-inch main to augment the water supply. Work will probably start very shortly. Engineer, E. S. Fenser.

Quebec, Que.
Tenders are being received for the demolition of the Tara Hall Building on St. Anne Street. Particulars from T. Reid Peacock, 81 St. Peter Street.

East & Masson, 62 St. Nazaire Street, have commenced the erection of a residence for J. E. Rouillard, 30 Maisonneuve Avenue. Brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $8,000.

Work has been started by F. Guillmette, 180 Ste. Therese Street, on the erection of a residence for Joseph Roy, St. Anselme, County Dorchester. Brick and frame construction, concrete foundation, metal and asbestos roofing. Estimated cost, $7,000.

St. Laurent, Que.
Sabourin & Company, 25 Decelles St., are building a residence on Papineau Street for Joseph Sabourin, 25 Decelles Street. Brick construction, concrete and foundation, felt and gravel roofing. Approximate cost, $7,000.

Work on the erection of three stores for J. H. Crevier, 58 Decelles Street, has been started by J. Dorais, 48 Decelles Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $8,000.

Toronto, Ont.
Work has been started on the erection of an addition to the store of Mary Bolland, 986 Bl9oor Street W. The masonry contract has been let to Teaglc & Son, 310 Davenport Road, and the carpentry to Hudson & Mosley, 5 Jerome Street. Approximate cost, $6,000.

Winnipeg, Man.
Tenders on the supply of approximately 200,000 barrels of cement will be received until noon, October 25th, by S. H. Reynolds, Chairman of the Commissioners, Greater Winnipeg Water District, 901 Boyd Building. Delivery is to be made weekly during the building season of 1916. Specifications at office of the Chairman.

Bricks Made Without Clay

Bricks without clay of an Illinois works open up a new industrial field. In this case the chief material is the tailings from coal mines, but it is claimed that the process is adapted for utilizing siliceous wastes of all kinds, thus providing a source of building material to localities having no clay. The coarse siliceous substance is brought into chemical combination with a binder of lower fusing point, consisting of suitable proportions of pulverized silica, alumina, potassium or sodium. The proper mixture is forced into molds under high pressure, and the bricks are burned in the usual way, but for a much shorter time. Samples produced were not cracked or damaged by a temperature of 2,900 degrees Fahrenheit, or by a cruching load of 20,000 pounds per square inch. The new process, it is claimed, will do much toward keeping down the high cost of living. As timber becomes more scarce its price has increased and in many localities builders have found it cheaper to buy bricks, even though forced to pay for a long freight haul. When it was first announced that bricks were to be made of coal many people laughed at the thought of using such material in fireproof construction. As a matter of fact, no part of the material used is combustible after being treated in the new process. It is said that the cost of the new material may be lower than brick even in territory near clay pits.

ESTABLISHED 1886

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The Coming Industrial Struggle

IN an address delivered recently at the Rochdale (Eng.) Technical School, Sir Swire Smith, M.P., made some noteworthy observations as to the vital importance of technical and scientific education and enterprise. It was pointed out that in the directions in which Germany had been Great Britain's most formidable competitor it had been found that her educational equipment had been the most advanced and thorough. As an illustration, there was the aniline dye industry, which the Germans captured from Great Britain more than forty years ago. In the great polytechnic schools—not of Germany only, but of Switzerland—the Royal Commissioners came upon the most renowned chemists teaching students how to put brains into their colours and make money out of them. It was said that, although most of the raw materials of the dyes came from England, the Mother Country had been importing artificial dyes from Germany and Switzerland to the extent of ten million dollars in value—a striking proof that the British had been paying for German scientific education by buying the product.

Canada will do well to give more and more thought to facilities for technical education. The cry "Buy made-in-Canada goods!" is pathetic in its puerility if we take no steps to see that the goods are really worth buying; and unless we can turn out men who will put brains into the goods we shall not be able to compete with German or any other competition.

We are told that a few years ago in one of the polytechnic schools of Germany there were more students above the age of eighteen taking full courses in chemistry than in all the schools and colleges in England put together! As a business proposition, the only way in which we can compete with others in making dyes, or anything else, is to take the same pains in learning how to do it, and it should be suggestive to Canadians to know that a British company has been formed with Government assistance in the hope of capturing at least a share of the aniline dye industry, and that the British Government has undertaken to make a substantial grant for the promotion of chemical research in the Old Country.

An idea of the extent of the readjustment that will come after the war may be obtained from the statement that German's imports to the British Isles in 1912 were valued at 260 million dollars, and that in the same year the British Isles exported to Germany goods valued at 135 million dollars. This huge trade in manufactures—the largest between Great Britain and any foreign country—is now entirely cut off. The articles "made in Germany" have now to be made in Great Britain and within the Empire. Why not a considerable part of them in Canada?

Why Contractors Fail

THE epitaph of many contractors who have fallen by the wayside should contain the warning: "He was too optimistic." Optimism is a mighty fine thing, but so is good, hard common sense, Engineering and Contracting points out. If some contractors would use more of the latter there would be fewer jobs finished by the bonding companies. It is a common occurrence for a contractor to bid on contracts about 10 sizes too big for him. He knows he has insufficient capital and inadequate plant to swing the work; yet his optimism is so great that he thinks he can 'pull through some way.' Sometimes he does, more often he doesn't. In any case, he is seriously handicapped even before he signs the papers. Lack of capital causes more failures than the old standby, too low or reckless bids. An analysis made by the National Surety Company of recent claims aggregating over $500,000 paid under contract bonds, showed that over 65 per cent. of the losses were due to conditions existing prior to the signing of the bond. Of this percentage inadequate capital accounted for 12.8 per cent., while low or reckless bids were responsible for 12 per cent. Insufficiency of plant was blamed for 4.1 per cent. of the losses, and errors in bids or calculations for 5.1 per cent.

The Montreal Waterworks and the Canadian Society

WE reproduce herewith a communication sent by the Canadian Society of Civil Engineers to the Mayor and Commissioners of Montreal on the subject of the enlargement of water-works, including the construction of the filtration plant and the proposed hydro-electric development. The scheme has been the subject of considerable controversy, and eminent engineers have expressed the opinion that it is not economical, that it has been undertaken without due consideration, and that even now there is not sufficient data to judge accurately the ultimate cost. Having regard to the problematical value of the hydro-electric section in particular and to other features, the Canadian Society strongly emphasizes the point that an independent body of engineers be appointed to consider the project before further expenditure, running into millions, is incurred. The original scheme has been so enlarged that it is quite a different proposition from the one first proposed, and engineers who reported on the original plan, or on isolated parts, including Hering and Fuller, the consulting engineers of the city, deny that they have approved of the scheme as it now exists. The hydro-electric end, to develop power for pumping and street lighting, is, in the opinion of competent engineers, a most extravagant proposal, which will entail a heavy capital cost, and what is still worse, a large annual sum for operation and maintenance. These sums will involve the generation of power at a cost much higher than that at which power can be purchased from private companies.

The Canadian Society reiterate their request for a thorough investigation into the entire facts, so that the plans can be modified or a portion of the works abandoned if the scheme is proved to be wasteful. The expenditure of a comparatively small sum will probably prevent the outlay of millions of dollars on works which will prove a heavy annual burden on the community.

Controller Cote, in an interview, suggests that the Society is too late and that the Council should have spoken before the contracts for the second widening of the aqueduct were let. The answer is that the Council were not aware of the extent of the scheme, and it was only when investigations were made as the result of the break in the conduit, that the extravagance of the scheme was revealed. Some eighteen months ago Messrs. J. A. Jamieson, R. S. Lea, and G. R. Heckle, who reported on the break in the conduit, made a strong representation in favor of an independent board of engineers advising on the whole scheme, and the names of an outside board were submitted, but Mr. Cote would have nothing to do with the suggestion. Following this it was proposed to make a further large outlay, and this led to a vigorous protest by the Council of the Canadian Society. Unfortunately, there is no known limit to the expenditure, for the plans and specifications of the power house have not yet been drawn, another retaining wall has to be built, and numerous other works carried out. It also appears that the conduit pipe, which parallels the aqueduct, is still leaking, and the Cook Construction Company, which is enlarging the aqueduct, has to maintain three pumps to keep the water out of the cut. Moreover, the company claim that it has about a quarter of a million's worth of machinery lying idle, as the city has been unable to obtain the land for the necessary widening on the south side of the aqueduct. This in all probability means heavy claims for damages.

Mr. Cote states that in the opinion of Messrs. Hering and Fuller, the only practical thing to do, after the expenditure of so many millions, is to complete the work, to which critics of the scheme reply that it would probably be more economical to regard a portion of the money as lost than to proceed with a project which will involve the rate-payers in many more millions and also prove a white elephant when finished. An independent investigation will, at any rate, show exactly where the city stands, and whether the strong criticisms of the plan rest on solid ground. The opinion of the Council of the Canadian Society, composed of men of the highest standing, ought not to be lightly disregarded, although the experience of the past does not lead to the hope of anything practical being done.

* * *

To His Worship the Mayor and the Members of the Board of Commissioners of the City of Montreal:—

Gentlemen,—On July 29, 1915, the Council of the Canadian Society of Civil Engineers addressed to your Board a letter suggesting that you stay the expenditure of public money on the water-works enlargement until the whole project had been examined and approved by a board of independent engineers. The communication from this Society was read at a meeting of your Board held on August 3rd, 1915, and it was proposed by Commissioner Cote, seconded by Commissioner Hebert, to officially transmit to the Canadian Society of Civil Engineers a copy of a letter written on the same subject by Commissioner Cote and addressed to Mr. J. A. Jamieson.

While the Council of this Society cannot undertake to discuss the technical points raised in Commissioner Cote's letter, it takes exception to the following paragraph contained in the communication to Mr. Jamieson.

"Notwithstanding the many favorable reports prepared by the engineers during the past quarter of a century and the more recent decisions arrived at since the beginning of the scheme of enlargement in 1907, all favorable to the carrying out of the works, you persist in coming forward to plead against the whole scheme as not being to the commercial advantage of the city."

This Council's exception to the foregoing quotation is that the work therein referred to is essentially different from the project now begun. The project contemplated in 1907 was for a minimum development of 2,000 h.p. at low water with mid-winter ice conditions, and it was not until November, 1910, that Mr. Janin submitted to the Board of Commissioners the project which is now partly under way. This project includes the construction of large filtration works, the construction of a hydro-electric plant of 10,000 h.p. capacity, and the widening and deepening of the aqueduct. The enlarged aqueduct is to carry the water necessary for the domestic supply of the city in addition to that required to operate the water wheels of a 10,000 h.p. development.

From Commissioner Cote's letter to Mr. Jamieson, the Council understands that your Board is under the impression that the complete project has been approved by the engineers named in the letter above referred to, and that such approval as has been given is sufficient to warrant the city in incurring the expense of the construction of the proposed works. Of the gentlemen mentioned, Messrs. M. J. Butler, George W. Fuller, G. R. Heckle, Rudolph Hering, J. A. Jamieson, John Kennedy, R. S. Lea, Ernest Marceau and J. E. Vanier are not on the staff of the city, but as they are members of the Canadian Society of Civil Engineers this Council deemed it proper to ask each of them to define the scope of his investigation and to communicate his findings with regard thereto. These inquiries have been duly answered. The Council learns from the statements thus obtained that no one of the engineers referred to has taken up the subject as a whole or studied it in any way which would enable him to judge of the merits of the complete undertaking. Further, the replies show that the professional work done and opinions given were in connection with isolated parts of the present project, or in connection with proposals essentially different from the project now begun.

In the light of this information the Council of the Canadian Society of Civil Engineers again respectfully urges that its suggestion be carried out without delay, namely, that the whole project be reported upon by a board of independent engineers before further expenditure is incurred. In laying this matter before your honorable body for the second time, this Council would urge the necessity for such a report in the interest of every engineer who has been connected with the project, the good name of the engineering profession, and in the interest of every rate-payer of the city of Montreal.

(Signed) C. H. McLEOD,
Secretary.

How the Engineer Can Widen his Influence and Better his Condition

IN an address delivered before the American Association of Engineers, Professor F. H. Newell calls attention to the fact that the engineer is rapidly awakening to a realization of his duty to society in general, to his profession, and to himself in particular. It is becoming increasingly evident that engineers are giving more serious attention to their welfare and influence, and are seeking to correct errors which have prevented them from securing fuller recognition from the public. At first, discussion centered largely on the direct compensation of the engineer, but it is encouraging to note that the term "compensation" does not enter so largely into the present discussion. It is being realized by those who have given the subject careful consideration that a more general recognition of the engineering profession, bringing with it improved conditions, must be secured on the grounds of public service. The public must be educated to a better understanding of the service which the engineering profession can, and is, rendering, and the engineer must present his claims for recognition in such a way that they will be readily accessible to, and understood by, those not technically educated in engineering.

In his discussion of the subject Professor Newell, who was formerly Chief Engineer and Director of the United States Reclamation Service, stated that the quality which distinguishes the engineer as a professional man from his brother, the mechanic, is education. To be an engineer in the true sense one must possess an education which will enable one to understand the true perspective of things, to know the big from the little, to obtain facts, and to judge correctly from these facts. To build the foundation for such an education we believe our engineering schools must give increased attention to those subjects which teach the fundamental principles of engineering, supplemented by subjects which tend to educate a man broadly and thus enable him to occupy common ground in dealing with well-educated men in other lines of work.

In speaking of service Professor Newell said:

> What is this service which all should be eager to render and which is the fruition of years of training? What do we mean when we claim that the highest function of the engineer and his greatest reward is found in engineering service? The word conveys the idea of help rendered to another, not as a favour involving an obligation, nor, on the other hand, as a matter of self-sacrifice. It is something which may be expected, although it cannot be demanded, and may be performed among equals. Service consists of those acts which tend to lessen trouble or increase the health, prosperity and convenience of others.
>
> Engineers in performing service are by this very fact entitled to full recognition. Service implies a suitable reward, and, while the effort may be altruistic, it does not involve unnecessary self-denial.

By his training the engineer is particularly fitted for public service, but he has not been able to accomplish the most good because the public has not been educated to a realization of the service which he is capable of performing. As pointed out by Professor Newell, the public is not wholly to blame for its lack of appreciation—the engineer is to a certain extent culpable. He has not fully felt the need for diffusion of information, except among his professional brothers. He has not taken the public into his confidence and explained, in ways which would attract the public, the results already achieved, nor has he given these a setting or application such that the ordinary citizen and taxpayer can comprehend how this work affects him, or how his condition may be improved. In this respect the engineer unquestionably has shown a decided weakness. He has demonstrated that he can solve great engineering problems of vital interest to all, but he has not shown the same degree of intelligence in improving the human machinery or in his dealings with other men. In other words, he has proved himself to be a good mechanic but a poor salesman.

Engineers can greatly benefit themselves, and at the same time better serve the public, by increased attention to those factors which do not involve the technical side of their profession. By co-operation, by educating the public to an appreciation of the service which they are capable of rendering, and by cultivating those qualities which tend to make them better citizens and better neighbours, they can vastly improve their present standing.—Engineering and Contracting.

Notes on Sewage Treatment and Disposal

Contributed by **R. O. Wynne-Roberts***

The Activated Sludge Process

ONE of the important features of this method of treating sewage consists in the diffusion of the air. Although sewage can be and is aerated by air discharged through perforations in pipes laid on or near the tank floor, it was found by Messrs. Ardern and Lockett in their classic researches that the dissolved oxygen content of the sewage charge was increased more expeditiously by the use of diffusers, as will be seen by the following table extracted from Ardern & Lockett's paper.

Dilute Sewage Time	Dissolved Oxygen Content when aeration effected by Plain Tube	 Diffuser
	Parts per 100,000	
At commencement	0.24	0.24
After 15 minutes	0.42	0.73
After 30 minutes	0.49	0.74
After 45 minutes	0.56	0.76
After 60 minutes	0.57	0.77
After 90 minutes	0.63	0.79

This phenomenon has been observed by all experimenters, and consequently porous tiles are employed to diffuse or atomize the air. These tiles are inserted in a rectangular iron casting, the joints between them are made air-tight, and air is delivered underneath the tile. A number of these are required in a tank, and the cost is rather great. These tiles can be obtained from Messrs. Jones and Attwood, of Stourbridge, England (Messrs. Laurie & Lamb, Montreal, agents), and from the General Filtration Company, Rochester, N. Y.

The use of porous tiles, however, tends to divide the tank floor into so many parts, and this obstructs the flow of the sludge towards the outlet. Tanks have been designed somewhat similar to the chambers of rapid filters, in which the floor has a series of ridges and troughs, and the porous tiles are placed in the hollow of the troughs. This, again, does not seem to be ideal, as the sludge as a whole is not aerated simultaneously, but as it falls from the ridges it receives its dose of air, and is carried upwards into the tank and mixed with the sewage.

If the process is to be efficacious, and the quantity of air required is to be reduced to a minimum, it would appear that the sludge and sewage should be aerated continuously for a definite period, and that this period can be reduced by causing the sludge, etc., to be in continuous contact with the air, instead of being aerated intermittently. This is possible if the whole floor is built of porous tiles, but the cost of it at present would be excessive.

The writer has been inquiring for porous bricks or blocks, made of fire-clay, ordinary clay, or concrete. Fire-bricks of certain makes are porous, and possibly the porosity of these bricks may be made to order. Ordinary clay bricks may be made porous by mixing sawdust, coal-dust, or other combustible substance with the clay before moulding the bricks, and when these are burned in the kiln the sawdust, etc., have been carbonized, thus rendering the bricks porous. Concrete slabs can no doubt be made porous by some means—either by employing coke, pumice, or other porous aggregate, or by moulding the blocks in forms containing a large number of fine spikes. There is room for a Canadian firm to produce cheap porous tiles for this purpose.

If fire-bricks were used to cover the floor instead of the present excellent tile, the cost would no doubt be much less. The contour of the floor must be approximately level; otherwise the air delivered under pressure will rush to the higher parts and forsake the lower, thus defeating the object in view. With a horizontal floor the sludge will, of course, not flow effectually until there is an accumulation at the extreme ends. This, however, cannot be advocated. Consequently some contrivance will have to be installed to sweep the excess sludge to the outlet. As in the activated sludge process, there must be about 25 per cent. of sludge in the tank to work efficiently. It will be an easy matter to design a sweeping device that will remove that portion which lies above the 25 per cent. level. For example, if the tank is 10 feet deep, and the sludge depth is, say, 3 feet, then 25 per cent. capacity is 2 ft. 6 ins.; consequently the rake must not work nearer the floor than that distance, but will remove that above the 2 ft. 6 in. level. Candy's spiral sweeper would no doubt answer this purpose if the tank is circular in plan.

The designing of a flat floor would not be difficult, if porous fire-clay slabs were available. The air would be discharged by a number of pipes under a hollow floor, and thus the movement of sludge above the floor would not be obstructed by any projecting diffusers, pipes, etc., located above the floor.

The spacing of the air pipes would be so arranged as to keep the hollows under the floor slab uniformly charged with air. A circular tank would permit of a spiral sweeping contrivance being operated by a central shaft and of the surplus sludge being discharged through one opening. A rectangular tank would entail the use of a travelling sweeper and more than one point of discharge.

In the operation of an activated sludge process, Prof. Bartow considers that the satisfactory aeration of a sewage is indicated by the oxidation of the free ammonia. This appears to be confirmed by the results obtained at Wakefield, England, and Milwaukee, Wisconsin, as will be seen by the following figures:

	Free Ammonia in parts per 100,000 Wakefield	 Milwaukee
Crude sewage average	37.50	16.00
After 2 hours' aeration	.....	7.00
After 4 hours' aeration	.....	0.60
After 6 hours' aeration	4.80	Trace
After 8 hours' aeration	.....	Trace
After 24 hours' aeration	0.60	Trace

—so that to ascertain whether the aeration is efficient, or if the oxidation is sufficiently complete, the principal check, apparently, will be the test for free ammonia, which is a very simple one. If it has practically disappeared, then the process has been carried through so far as the particular charge is concerned. This statement, however, must be confirmed by experience and further knowledge.

While the ammonia is oxidized, and nitrates are formed, the oxygen absorption has also been greatly reduced. The organic matter remaining unoxidized may be checked by the methylene blue test. This test depends on the relative avidity of the impurities contained in the water for oxygen. If the blue color disappears in a few hours—that is, the oxygen in the solution has been exhausted—it shows that the sample of effluent under test is relatively poor in quality; while if the color is retained for several days it indicates that the sample is good. Prof. Phelps has formulated a scale by which the relative stability of the effluents can be recorded. The methylene blue test has been adopted at many sewage treatment works, and if colloids have been removed it is reliable.

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* Consulting Engineer, Toronto.

There is another test—namely, Dr. Lederer's saltpetre test—which he calls the "biochemical oxygen demand." This is a subject that will be discussed in another collection of notes on sewage disposal.

Principles Governing the Study of Public Water Supplies*

By Percy Griffith

A comprehensive study of this subject will bring you into contact with almost every branch of science, will involve the investigation of almost every known law of Nature, and will necessitate the study of many social and economic laws. Hence the prospective water engineer must commence by careful study of the mechanical and physical sciences; he must miss no opportunity of observing the fundamental laws of Nature; he must acquire a practical knowledge of social and commercial principles, and, to secure prominence in the profession, must collect, absorb and apply information of all kinds from all sources with intelligent enthusiasm and untiring assiduity.

The subject of waterworks naturally divides itself broadly into two parts—(1) gravitation supplies from upland gathering grounds, and (2) surface and underground supplies requiring to be pumped. I will deal with these in turn. Meanwhile I must point out that, as Nature but rarely provides pure water under conditions which dispense with the intervention of the water engineer, this profession is one of the most ancient known to man, and works executed hundreds of years ago prove the substantial manner in which the early water engineers designed and carried out their works. These works were all of the "gravitation" class, as pumping machinery was at that time unknown except on a small scale, and in the form of elementary elevators worked by manual or animal powers.

Gravitation Supplies from Upland Gathering Grounds

Although this class of works is the simplest, is must not be assumed that schemes of this character can be designed and carried out without considerable study and experience. In the first place they are proportionately far more costly than pumping schemes; but beyond this failure involves consequences of a far more serious character, and the calculation of the available supply of water and the capacity of the reservoir, the selection of a suitable site for the embankment or dam, and finally the design and execution of the works themselves, involve difficulties which can be overcome only by the most elaborate investigation and careful study, and after many years' practical experience in subordinate capacities, under engineers in active practice.

I will now deal with these points briefly in the sequence stated.

Calculation of the Available Supply of Water and the Capacity of Reservoir Required

This matter is one involving some very interesting investigations, but it is first necessary to grasp the real purpose to be secured by the impounding reservoir—viz., the adjustment of the available supply to the demand. Now the daily demand in any given town varies considerably during the year, more so in purely residential areas than in those with manufactories or works using water for trade or manufacturing purposes. This variation is, however, more conveniently provided for by service reservoirs constructed either on adjacent high ground, or on towers in cases where no hills are available. As regards impounding reservoirs, therefore, we may assume the daily demand to be constant throughout the year, and may start by an assumed average daily demand to be provided for by the intended works. This figure must, of course, be large enough to provide for the anticipated increase during a period of years, as works of this character are too costly to be enlarged or duplicated at short intervals, as may be done with pumping schemes.

Having arrived at the daily quantity to be provided at the reservoir outlet it remains to be determined what capacity of reservoir is necessary to secure such a supply from a constantly varying inflow from rainfall. The most certain method of doing this is by gauging the flow of the stream draining the watershed at a point corresponding to the site of the dam.

A difficulty arises in gauging the flow when there is a wide difference between the maximum and minimum flow, because when the stream of water flowing over the notch is less than 3 in. or more than 2 ft. the formula from which the rate of flow is obtained becomes inapplicable. In streams liable to heavy floods, therefore, the weir should be provided with movable sides, or it may be stepped along its length. It is important to provide a large and deep reservoir on the upstream side of the weir to prevent the water from approaching the notch with any considerable surface velocity; the water must have a clear fall below the notch to allow free access of air to the underside of the discharging stream, and the depth of the stream passing over the notch—which is the coefficient from which the flow of water is calculated—must be measured at a point some distance back from the notch, where the water is without appreciable movement. Various formulae are available for calculating the flow from the depth of water passing over the sill, but they are too complicated to be explained in this short lecture.

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*From a lecture delivered recently before the Birmingham University Engineering Society.

It is, however, rarely possible to obtain sufficient records of the flow of streams to enable a reliable estimate to be made of the average maximum and minimum supply available, from which the capacity of the reservoir and of the overflow channel are calculated. Daily records over a long period of years would alone give reliable data, and it is usual, therefore, to utilize rainfall records. If such records are not available for any particular watershed, it is possible, by comparing local gaugings taken over a comparatively short period with gaugings in similar watersheds where longer records are available, to deduce a fairly accurate estimate of the essential figures —that is to say, the average rainfall of three consecutive dry years, which is usually accepted as the basis for calculating the storage necessary in any given case.

In this country the amount of storage required—expressed in terms of $\frac{\text{Total storage}}{\text{Daily demand}}$ varies from 120 days to 250 days, but in tropical countries like India it may be necessary to impound a quantity representing the total demand of a period extending to two years or more than 700 days.

In these calculations due allowance must be made for losses by evaporation and percolation. The former may in this country amount to from 12 in. to 27 in., calculated over the whole watershed or gathering ground, and varying according to the slope of the surface and the nature of the vegetation and subsoil. Loss by percolation should be prevented by carrying the watertight core of the dam down to solid rock throughout its length.

I must here say a few words as to the method of arriving at the average daily demand, which is the main factor in the calculations for storage capacity. This is usually expressed in terms of gallons per head of the population, but when it is realized that the supply to be provided must include water required for trade manufacturing and other non-domestic purposes, it will be seen that no standard rate per head can be accepted as common to all cases. For purely residential districts the rate may vary from 15 to 20 gallons per head, but in industrial areas it may rise as high as 50 gallons per head, and in many American and Continental cities the consumption reaches 120 to 150 gallons per head of population. In London the average consumption is 36 gallons per head, and this may be considered as a very liberal allowance for any area, including both residential and industrial properties, while for rural areas without any appreciable trade demand a supply of 15 gallons per head is ample.

Selection of Site for Impounding Reservoir

This is a problem requiring experience and judgment for its solution, because the cost and efficiency of the scheme will depend very largely upon the relative suitability of the site selected, and a mistake at this stage may involve a vast increase in the cost of the works, and even the risk of ultimate failure. If you are familiar with the mountains of Wales or Cumberland, you will realize at once that the configuration of the smaller valleys affords everything necessary to the formation of an impounding reservoir except a wall or bank across a valley. The main question is therefore where a watertight bank or wall can be most effectively and economically constructed. The most important points for investigation are (1) the impermeability of the area to be covered by water, and (2) the possibility of constructing the dam so as to intercept the whole of the available yield of the gathering ground; in other words, Nature must provide a watertight basin, or it is useless to endeavour to collect water in it. Fortunately these mountainous areas are usually formed of the older and deeper rocks which are for the most part impervious, but which are generally much "faulted" and fissured. Having ascertained by careful examination that the area of the intender reservoir is generally impervious, it is necessary to determine at what depth a homogeneous and impermeable rock will be found in which the base of the dam can be effectively sealed. This information is obtained by sinking trial holes (or wells), and borings at various points along and across the valley.

Suitable conditions having been found to exist, a contour survey of the valley immediately above the site or sites suggested for the dam must be made, in order to estimate the height of dam required to impound the quantity of water previously determined.

At this stage consideration must also be given to other questions, such as the proximity of materials suitable for the construction of the dam, the existence of roads intersecting the area to be covered by the reservoir, the liability of the gathering ground to pollution, etc., and with this information it will be possible definitely to select the most suitable site for the dam, and, this being settled, to proceed with the design of the works.

Design and Execution of the Works

In "gravitation" schemes the works, comprise many important items besides the embankment or dam, as, for example, a by-wash channel for diverting the stream from the reservoir in times of flood or during repairs, an overflow channel for releasing surplus water without injury to the dam, an outlet tunnel with pipes and valves for controlling the amount drawn from the reservoir, apparatus for regulating and measuring the quantity of "compensation" water, apparatus for filtering the water supplied to the town, the pipe line or conduit conveying the water to the town, etc., but in this short lecture I cannot do more than briefly refer to the construction of the embankment or dam and the works immediately connected with it.

There are two types of dams, the embankment of earth with a core of puddled clay and the masonry dam. The former is by far the more common, and for moderate heights it may be looked upon as perfectly satisfactory and as more generally applicable than a masonry dam. A trench is first of all cut across the valley, extending to the solid rock, and the materials excavated from the trench must be distributed over the area representing the base of the embankment, as it is important that this large quantity of material should not have to be moved twice. The portion of the bank immediately adjacent to the puddle core must, however, be formed of specially selected material, and it is the special function of the engineer so to organize the work as it proceeds that a sound and efficient result may be obtained at a minimum of cost. You will observe that during the digging and filling of the trench the water flowing in the stream must be carried over the excavation by a temporary bridge, and it is important to see that this is constructed of sufficient capacity to carry the maximum flood which may occur during the period in question, otherwise the trench may be flooded and much loss of time and money result.

The trench being completed, and a portion of the bank proportionate to the depth and width of the trench formed, the next step is the filling of the trench with either clay puddle or concrete. Engineers differ as to which is preferable, assuming both are equally available, but there is probably less skill required, both in the work itself and in its supervision, if puddle is used. At the same time concrete will be more generally available than clay, and the engineer must make a special study of the precautions necessary to secure watertight concrete, as this material is constantly required in the construction of waterworks. Having completed the filling of the trench, the bank and puddle core are then proceeded with. The work must be carried up as uniformly as possible throughout its length, the bank being formed in layers of about 3 ft. thickness, each well consolidated before the next layer is added.

Through the lower portion of the bank is constructed the outlet tunnel, which is usually placed as nearly as possible adjacent to the original bed of the stream, in order to drain the lowest part of the reservoir. This tunnel will ultimately be provided with the outlet and wash-out pipes, and on the completion of the dam will be bricked up for a length of from 10 ft. to 20 ft., so as to prevent water escaping through it.

The design and construction of the overflow is particularly important in the case of earthen embankments, because should the overflow be insufficient to carry away flood water, and the reservoir begin to overflow on to the earthwork, this would be rapidly washed away, and the whole structure be in danger of collapse. Many terrible disasters have occurred from this cause, and it is therefore desirable to make very liberal estimates in calculating the maximum quantity of water to be provided for in the overflow and channel leading from it. In some cases the overflow and its channel have been constructed in the adjacent hillside, so that these works are quite independent of the embankment; but, of course, this is a more costly method than the more usual practice of constructing the overflow at one end of the bank and carrying the channel down the angle formed by the bank and the hillside. The overflow and channel must, for obvious reasons, be constructed in masonry or concrete.

In a masonry dam the base of the dam must rest throughout its length and breadth on solid rock, and unless this can be formed comparatively near the surface, the cost of the work is likely to be prohibitive. The profile of the dam affords some scope for variety, and practice reveals many alternative types; but the calculations for stability are more or less identical with those involved in retaining walls. It is accepted as a maxim that the stresses forming the resultant of the water pressure and the weight of the structure should fall within the middle third of the section. Masonry dams, besides being more suitable for deeper reservoirs, offer the further advantage that, at but little extra cost, they may be so designed as to permit of their being raised should further storage be required at a subsequent date.

(To be concluded.)

The use of paint to protect steel reinforcing members in concrete work against damage by electrolysis, has often been proposed. Seldom, however, have tests been conducted to determine the type of coating best adapted for this purpose. Paints having a high insulating value are generally those drying with a high gloss, which is apt to prevent proper bonding—a fact which has no doubt had much to do with preventing a general use of this protection.

Mechanical Equipment for Road Work

UNUSUALLY complete mechanical equipment has recently been used on a road job in Indiana. The work comprised the construction of about 11½ miles of concrete road between South Bend and New Carlisle. The sand and gravel were excavated by a steam shovel, which dumped the material into bottom dump cars which were hauled by a small locomotive to a trestle over a hopper. From the hopper the material was carried to a revolving screen, where the sand and gravel were separated from the large stones which were run through a gyratory crusher and again screened. The gravel was transferred from the bin at the screen to a washing plant by a belt conveyor, where it was separated into sand and two grades of gravel and deposited in bins. From these the material was loaded into cars on the Chicago, Lake Shore, and South Bend Railway, which parallels the road under construction. The contractor's storage was situated at a siding about three miles from New Carlisle. The railroad at this point being on a fill, the cars were dumped into a hopper under the track from which the material was carried by a bucket conveyor to the bins. From the bins the material was discharged through chutes to industrial cars, in which it was carried to the work. The industrial railway also carried the cement from the contractor's storage yard to the work.

Concrete Road Construction

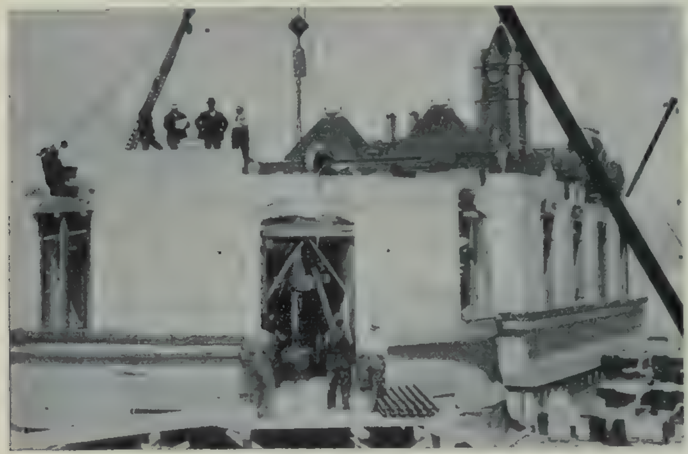
That the economic efficiency of concrete roads is at present undetermined but that the indications are that this type of construction will prove well suited to certain conditions is, in substance, the first of the conclusions arrived at by Charles H. Moorefield and James T. Voshell, Senior Highway Engineers of the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, in a recent bulletin on "Portland Cement Concrete Pavements for Country Roads." Among the other conclusions set forth are the following: That the one-course type of pavement is much preferable to the two-course type, although there are conditions under which the adoption of the two-course method may be justifiable; that the proportion of the cement to sand and coarse aggregate should not be less than about 1 to 5, and that the proportion of sand to coarse aggregate should not be less than 1½ to 3 nor greater than 2 to 3; that all types of expansion joints which have yet been devised require careful and frequent attention to prevent rapid deterioration in their vicinity, and better results are obtained by placing the joints at an angle of about 75 degrees to the centre line of the road; that thin bituminous wearing surfaces for concrete pavements can not at present be economically justified, although it is possible that experience will develop some method of constructing such surfaces to give uniformly satisfactory results, and that intelligent engineering supervision is absolutely essential in concrete pavement construction because defective materials or workmanship can not readily be repaired after the completion of the pavement and are not usually apparent until a pavement has been in use for some time.

The New Provincial Law Courts at Winnipeg—Features of Design and Construction

(Staff Article.)

MANITOBA'S new Provincial Law Courts, now nearing completion in Winnipeg, represent a structure of dignified and imposing proportions, and a building which will rank with the finest public undertakings in the province. Situated at the corner of Broadway and Kennedy Streets, the building illustrated herewith is three storeys high, and oblong in shape. It covers an area of 233 feet by 200 feet on a site immediately opposite that of the new Parliament Buildings. In the publicity which has attached to the latter undertaking, the Law Courts have remained in the background, and so it is that an article dealing with their design and construction may be opportune and interesting.

The foundations of the building are of reinforced concrete, known as a floating foundation. The building is of steel frame construction, with concrete floors throughout. Cut stone is employed from the foundations up, there being an interior backing of local clay brick. Tyndall stone from the local quarries is used.



The dome under erection.

The main walls of the building are 22 inches thick. Some of the blocks of stone used in the construction weighed as much as seven tons. The interior finish throughout is of marble and oak. All the doors are of steel. The building is heated from the Provincial Power House, situated in the same grounds— a building constructed recently at a cost of $300,000. It is the intention of the authorities that this power house shall supply power and heat to all the Provincial Government buildings.

Two court rooms, each 60 by 40 feet, with marble floors, are situated on the first floor. On this floor, also, there are five judges' rooms, a witnesses' waiting room, judges' dining room, barristers' dining room, and a students' lecture room 40 feet square. Worthy of mention on this floor are prothonotaries' vaults, janitor's quarters, prisoners' waiting room, eight cells, lavatories, cloak-rooms, kitchen, and warders' rooms.

The outstanding feature of the second floor is the Assize Court, which is 47 by 65 feet in dimensions. There are also a court room 70 by 40 feet, a library, five judges' rooms, a sheriff's room, registrar's quarters, two prothonotaries' offices, a grand jury's room, and three jurymen's rooms, making up the balance of the accommodation on this floor.

The third floor contains a large library 140 by 48 feet. Surrounding this room is a fine gallery. The floor is constructed of cork. There is a large room devoted to the Court of Appeal, which has oak panelling and a cork floor. In connection with the Court of Appeal there are five judges' chambers, barristers' consulting rooms, and a referee's room. These rooms are surrounded by a twelve-foot corridor, having a marble floor and marble dado surrounds.

On approaching the new Law Courts the most noteworthy feature is the magnificent stone and copper dome to the southeast of the building. This dome rises 124 feet above the street-level. It is attained by an iron stairway running from the roof of the building.

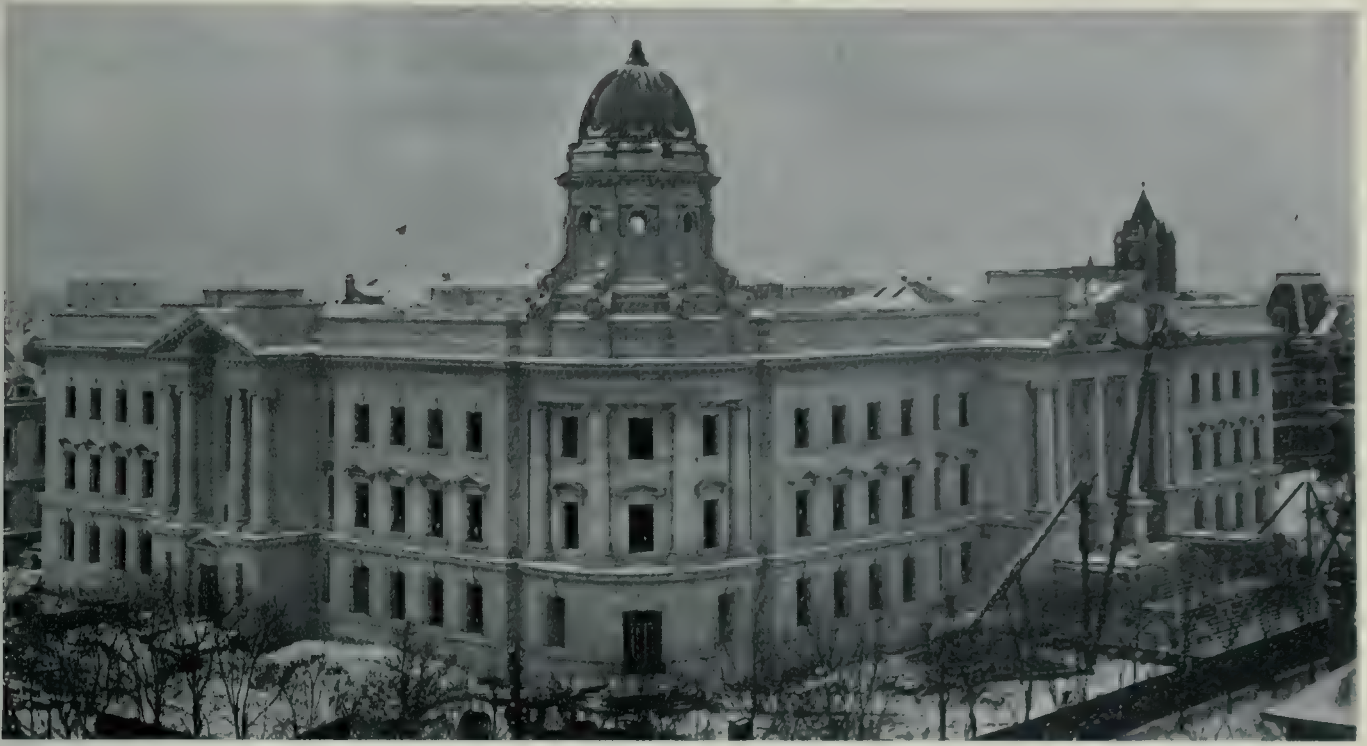
The main entrance to the Law Courts is situated on Kennedy Street. The steps, which are of Kettle River sandstone, are 83 feet wide at the base, and project 54 feet from the front of the building. The rise of each step is six inches, while the tread is fourteen inches. At the side of the steps near the top are located two large stone bases, upon which it is intended to place statues. There are columns of bush-hammered stone, which support a carved cornice. Part of the ornamentation is a Statue of Justice, while the cornice is engraved with the words "Law Courts."

It is estimated that the following quantities were required in the erection of the building: three million brick, 150,000 cubic feet of cut stone—all of which was cut and erected in ten months, 100 carloads of cement, 800 tons of iron and steel, three carloads of plate glass, and 35 carloads of marble.

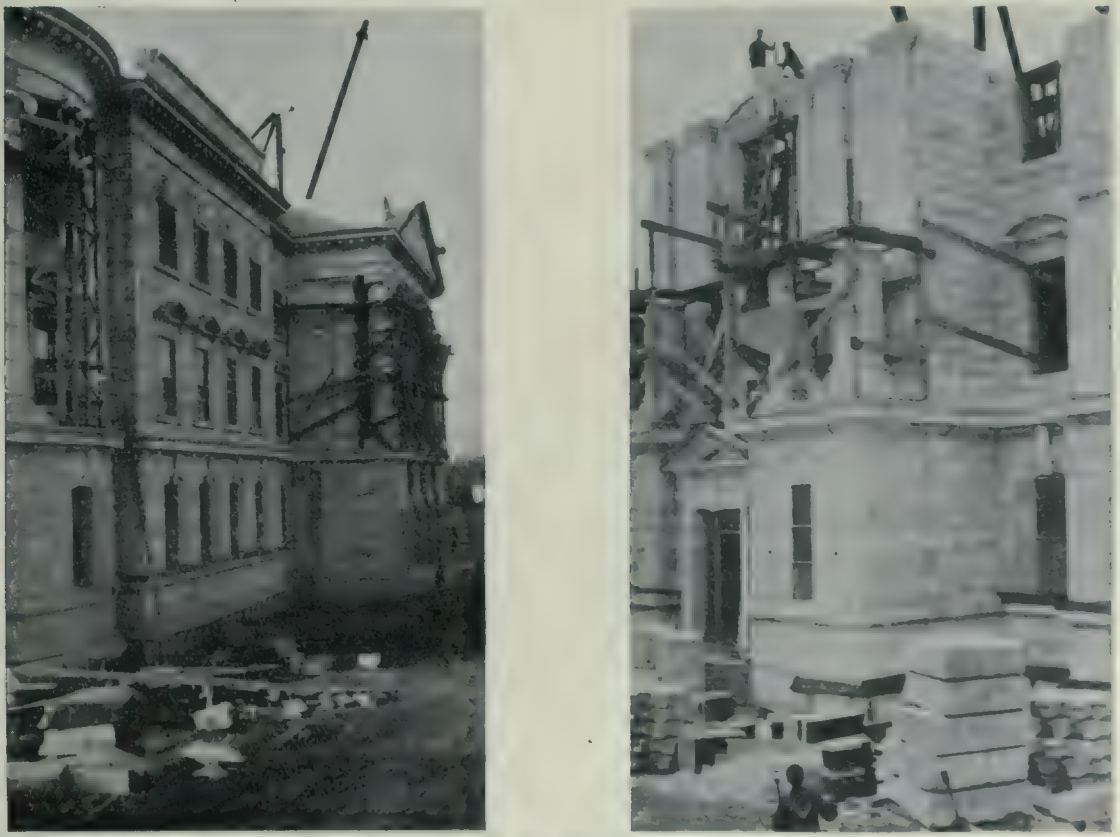
The contractors for the building were the National Construction Company, of Winnipeg, whose representative was Mr. J. M. Kelly, to whom we are indebted for the accompanying views. The iron and steel in the building were furnished by C. A. P. Turner, of Minneapolis and Winnipeg, while T. Kelly & Sons, of Winnipeg, supplied the cut stone.

A tunnel 360 ft. long on the Southern Pacific Railway was closed against traffic in May last owing to several falls of earth due to a fire breaking out in some timbering in the tunnel. It was evident that the tunnel could not be re-opened for six weeks, but it was thought that a deviation line round the shoulder of the mountain could be built in twenty-one days, and this was decided upon. The work was begun on a 450 ft. trestle, 90 ft. high at its highest point, crossing a canyon. The trestle was completed in nine days and nine hours from the time the material was ordered by telegraph from Oaklands, 350 miles away. This allowed for a steam shovel to commence at the south end and to meet that working from the north end, and the deviation was completed in nineteen and a-half days.

Small parts of the Roman walls which formerly surrounded the old city of London are to be found at various points in the modern city. One interesting fragment is in the basement of a modern building near the Tower. Regular rows of Kentish ragstone alternate with flat, red tiles, and both are laid in cement. Another section of Roman wall was recently unearthed in the courtyard of the new General Post Office.



The New Provincial Law Courts, Winnipeg



Provincial Law Courts, Winnipeg.—Progress views which illustrate the character of the cut stone work. Note the large slabs: several slabs used in the building weighed seven tons.

Field Notes on the Preparation of Estimates for Mill Construction

THE following data will be found of value in estimating the cost of mill construction, particularly mill construction for metallurgical purposes. The figures given are taken from the writer's field notes, and by modification they can be applied to any similar work. Mill construction costs are widely variable and no two mills are alike, nor will their construction be carried on under the same conditions, yet the construction work itself is much the same in all.

Preliminary Work and Material Lists

After it has been determined what kind of a plant is needed, and after the site has been selected and the drawings made, a thorough organization of plans should be established and every detail gone over in the mind's eye.

The first step is to estimate the yardage to be excavated, the amount of masonry or concrete work required, and then a complete list of all material should be made. The tendency is to overlook a multitude of small things which have considerable value in the aggregate. To the machinery specifications should be added a complete list of lumber, doors, windows, all hardware down to nails, pulleys, belts, lime, sand, broken rock—in fact everything that goes into the construction. The cost and weight of this can readily be determined by consulting reliable dealers and adding the necessary freight charges.

Development Plan and Estimate of Cost of Preliminary Work

The next step should be the working out of a thorough development plan and an estimate of its cost. Everything should be made ready, so that when actual construction starts there will be neither confusion nor delay. The cost of this work is considerable and it is often neglected, with the consequent addition of excessive costs to some other part of the work. A great amount of future trouble and worry can be avoided by a careful planning for a few important features, which will be mentioned.

Unloading facilities and material and tools to do it should be provided. A good road to the plant should be built and convenient deliveries arranged for. It is a noticeable fact that many a well constructed mill has such poor facilities for reciving supplies that the extra cost for a year would probably build everything needed to make such work easy and cheap. Ample room ought to be set aside for timber yards and all lumber should be marked and piled so that a glance will determine just what part of the job it was bought for.

A handy place should be marked off for a storage house and its cost estimated. It is surprising what a number of small things will be lost or misplaced without such storage. Roomy framing plots, as level as possible, should be marked off and handy places for machinery storage determined, keeping in mind pieces which will be first used and their situation. The supply of gravel, sand and rock must be looked into and arrangements made for its cheap delivery at any point. All details for disposing of rock and earth excavated with the least possible amount of handling should be planned.

The labor question must be studied and complete arrangements made for the comfort of the men. Their efficiency will vary directly with the conditions of their surroundings. Recently, in the west, a so-called mining man who had never given human nature a moment's thought attempted to build a mill in an out-of-the-way place with no fit accommodation for anyone but himself. The results were disastrous for the company. Good men could not be kept and the mill was finished up at an excess in cost of more than $50,000. Some of the tanks collapsed on their foundations with the first filling.

The cost of all this preliminary work can be estimated by the man on the ground; it averages from 5 to 10 per cent. of the total. If it is neglected, confusion and delays throughout the job are the inevitable result. Good organization is just as essential to the construction of a plant as to its operation.

Erection Costs

Erection costs are variable and can only be obtained by experience or by comparison with other jobs. If all necessary steps are taken to avoid delays estimates can be made dependable within reasonable limits. Fixed rules cannot be given for this part of the work. They will vary with the wages, efficiency of labor, climatic conditions and the experience of the man in charge. However, if the rules given in this article are applied for summer work in the United States, the estimate will come approximately close to actual cost. Labor wage is based on the average paid in western mining camps.

Superitendence can be figured when conditions are known, and will average, including cost of plans, from 3 to 5 per cent. of the total. Excavation by picking, shovelling, and hauling average earth in wheelbarrows, moving 100 ft., will cost about 45 cents per cubic yard; add one-third of hourly wage of laborer for every additional 100 ft. Where mine cars can be used to advantage this may be cut to 35 cents per cubic yard, moving 100 feet; add one-fifth of hourly wage for every additional 100 ft., which covers placing the track. Breaking rock by hand, like hauling conditions, will cost from $1.25 to $1.75 per cubic yard, with 100 ft. haul. It will cost a few cents more per cubic yard than in earth work for every additional 100 ft. There are so many unknown quantitites entering into excavating that these figures are only roughly approximate.

Masonry and Concrete Construction

Rubble masonry will average $5 per cubic yard, using cement mortar. A mix of one part of Portland cement to five parts of sharp, clean sand will give good results. Such walls will average about 15-in. courses and will require from ¼ to 1/3 cu. yd. of mortar per cubic yard of wall. Concrete work can be figured to a nicety when conditions are known. With a mechanical mixer, $1 per cubic yard will cover the cost of mixing and placing in the average mill. On a large job it is well to determine just what mix is required with the material used. The duty of the sand is to fill the voids in the broken rock and, when the two are mixed, the resultant voids should be filled with cement. It is well to allow 10 per cent. excess in each case, but there is nothing gained by using a richer mix for retaining walls and foundation. However, if a weaker mix is desired it can be obtained by puddling instead of cutting down the proportion of sand and cement. In forms of any size puddling is good practice and the strength of the concrete is by no means decreased. Clean, firm rock should be used and the edges should not touch. On the average mill job concrete will not cost more than $7 per cubic yard for large forms, $8 for medium, and $10 for small and heavy-duty machine foundations, including the cost of the forms. By using old iron, reinforced concrete can be made for 50 cents per cubic yard more. Floors with a 5-in. base and 1-in. covering will average from $10 to $14 per cubic yard.

Hauling

Unloading and hauling depend upon conditions. There will be a fixed average charge of from 30 to 40 cents per ton. Small pieces should be handled for less, but large, unyielding pieces, such as a tube mill, can easily cost up to $1 a ton. Probably 75 cents a ton-mile would be a good average for hauling on any kind of a decent road and grade. By consulting local freighters these things can be definitely settled. The curve of Fig. 1 shows the variable cost of hauling on different grades.

Carpenter Work

Carpenter work with a well organized crew of millwrights will average about $21 per M. for framing and erecting; $12 to $15 per M. for siding and roofing; and $2.50 per M. for shingles, or 75 cents to $1 a square for corrugated iron roofing and siding. With a picked-up local crew, $28 to $31 per M. for framing and erecting, $9 per M. for siding and roofing, and $2.50 per M. for shingles or $1.25 per square for iron, will be the average figures.

Table I.—Nails Required in Erection Per M. Ft. B. M.

	Size, d.	Lbs.
Siding and roofing	8	18 to 21
Flooring (1-in. material)	8	28 to 32
Flooring (2-in. material)	20 or 30	20 to 25
Studding, etc.	10	14
Shingles (per 1,000)	4	6

The nails required in this work per M. will be about as shown in Table I.

Assembling and Erecting Machinery and Equipment

Assembling and erecting machinery depends upon the nature of the machinery. A good point to emphasize here is that poorly stored machinery may easily add several dollars a ton to erection costs. An experienced engineer will size up the job and divide the material into different classes. It is then usually figured on a tonnage basis. Generally speaking, the heavier the piece the less the erection cost a ton. Steel tanks over 3/8 in. thick can be erected for $35 a ton; and 3/8 in. or less from $40 to $45 a ton. To place engines, stamps, crushers, pumps, to line up shafting, set electric motors, including wiring, etc., the cost will be about $45 a ton of iron; to set up concentrating machinery, classifiers, filters, etc., from $50 to $65 a ton. These figures cover the necessary carpenter work, placing pulleys, belts, and adjustments. When the carpenter work is figured separately these figures are high. Under these conditions it will cost from $25 to $30 a ton of iron to place engines, stamps, crushers, line up shafting, etc. To set up concentrating machinery, classifiers, filters, etc., costs from $30 to $45 a ton. This, of course, includes placing pulleys, belts and adjustments. The pipe work in the average mill will cost from $40 to $45 a ton. Erecting wooden tanks costs around $12 per M. Reduction works constructed wholly of steel are now becoming popular where the winters are not too severe. Framework of steel can be erected for $12 to $15 a ton by contract. A good contractor with a crew of construction men will make money at these figures. However, the amateur will do well if he shades the figures at all.

Recently the construction of a 50-ton combination concentrating and cyanide plant came under the writer's notice. The contract was taken for just a little under $30 per M., and the same price a ton for machinery erection, which also included all foundations and concrete work. The total cost of the mill was around $30,000, but it is just under a finished product in every way and is bound to give considerable trouble that will eventually cost more, not considering delays, than the extra thousand or so dollars it would have taken to make it a finished mill in the first place.

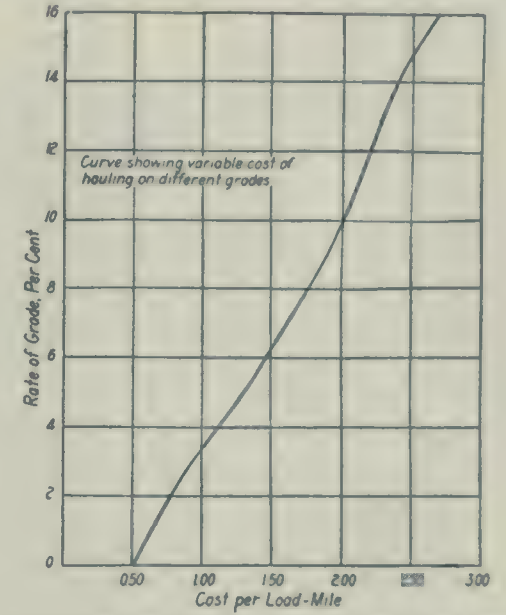


Fig. 1.—Curve showing effect of grade on hauling costs in mill construction.

Small items are important and there are a number of them. Considerable timber is required for staging and a number of unavoidable losses must be allowed for. The building should be painted, fire protection and heating arranged for and office and laboratory equipment bought.

Cost of Making Alterations

The expense of the breaking-in period and the necessary alterations are often overlooked. Here we have the personal equation entering. It is a bet by the designer and constructor on his own ability. It is a good idea to allow 10 per cent. of the total cost for possible changes, while any excess is often useful to cover the expense of unavoidable delays. The writer has in mind two mills, designed by two well-known metallurgists, where the starting up period in one case took five per cent. of the total expenditure and 15 per cent. in the other. The operator has a problem different from that of the man who follows construction only. When the former designs and constructs a mill he must worry through the breaking-in period and come out with a mill that is satisfactory in every way. On the other hand, the construction man generally has a contract and his responsibility ends by turning over a mill that is up to specifications, which may mean a good mill or a very poor one from the operator's standpoint.

Difficulties of Winter Construction

In the northern United States winter work is a tough undertaking at its best and should be avoided if possible. With an average winter the excess cost will easily foot up to 33 per cent. of the total labor expenditure. With an open, mild winter these figures are high, but with a cold, snowy winter they may easily reach fifty per cent. Concrete work often costs 35 per cent. more, as complete arrangements must be made for heating and protecting against frost until after the preliminary set. After twelve hours, freezing can only retard the final set, but cannot injure the concrete.

A brief description of methods used in a winter concrete job should be of interest. A steam coil 12 x 12 ft. was made out of 2-in. pipe spaced 1 ft. apart, and perforated every 6 ins. with 3/16-in. holes. This made it possible to keep plenty of broken rock heated ahead of the mixer. Barrels were arranged on the mixer platform so that the water could be heated to the boiling point with steam. A 10 per cent. salt solution was made, which is no way seemed to damage the concrete. The sand was not heated. Live steam was turned into the forms before pouring, sufficient time being allowed to draw the frost a few inches. Large forms were simply well covered with canvas after filling; the concrete remained above the freezing point for a couple of days even in the coldest weather. Small forms were protected by steam hose and fires for 12 hours. Calcium chloride is probably better than sodium chloride, since its solution freezes at a lower temperature and it also increases the waterproof quality of the concrete. It has been proven that concrete with 2 per cent. of calcium chloride gives the best resistance. More than 2 per cent. of it unduly increases the speed of setting and weakens the concrete. Since from 10 to 15 per cent. of water is used in mixing concrete, a 2 per cent. mix would be given by using a 15 or 20 per cent. solution. A 20 per cent. sodium-chloride solution freezes at about 7 degs. F., while a 20 per cent. calcium-chloride solution will not freeze until it reaches about the zero mark.

On a winter job of any size an inclosed framing shed will pay for itself many times over. It is not only useful during the framing period, but is a happy addition on a bitter cold day during the erecting period when the carpenters would otherwise have to be laid off. There are always launders, doors, plate beds, and a multitude of small things that they can work at under protection from the weather. When the mill is finally under cover it can be kept comfortable and the work will go on much more efficiently.

Remodelling Old Mills

Remodelling old mills is in a class by itself and each case presents a special problem depending upon the extent of the work and the condition of the mill. Like a new mill the cost of excavating, concrete, machinery, etc., can be rather accurately figured on, but the amount of hardware and lumber that can be used again and the amount of new material required is often misleading. The carpenter work and assembling of machinery will generally cost twice as much as in a new plant. It is a tearing down and building up process that no rules can be given for.

General Comment

The main causes for underestimates are:

Guess work, lack of good organization, false economy, omissions and change of plans, neglect of preliminary work, too much reliance placed on general figures, and inefficiency of labor resulting from surroundings. Under unavoidable circumstances may be mentioned unexpected strikes or inefficient labor, bad-weather delays and the failure of railroads or supply houses to deliver material as expected.

Any reputable machine house will give valuable information. Nearly all have one or more experienced engineers and will gladly go into all details with the buyer. It is a mistaken idea to think that they let their responsibility end with the last car of machinery that leaves their plant. This is far from being the truth, as the writer knows through personal experience that they will go to considerable expenditure of time and money to start a plant right or to give sound advice at any time. There are plenty of would-be metallurgists who are always willing to build a plant for half the bid of a reputable house, but without exception they are a most expensive "economy." This also applies to the manufacturer of untested goods. Almost without exception a small mining company cannot afford to experiment with such things. If there is merit in the innovation the larger companies will soon pick it up and demonstrate it.

While realizing that these figures are subject, to a certain extent, to the criticism of experienced construction engineers, they are given with the hope that they may be useful to some operator who finds himself up against a mill-construction job. If the plans are followed, a good organization maintained, and efficient labor secured, the figures will be found a little higher than actual costs. Mill construction is by no means an easy science, but experience will give every one his own empiric formulas upon which he can bank. Sectionalized machinery for mule-back haulage cannot be erected at these prices.

The foregoing data were taken from a paper by Harry T. Curran, in Engineering and Contracting.

AMONG the most intricate problems for statesmen to settle arising out of the course of the present war is finding out adequate measures with which to meet injustice done, observes the London Builder. The German Government apparently has no regard for the private property of its enemies, and has removed the plant of factories in Northern France in order to set them up in Germany. Are the Allies, when the opportune time comes, to follow the precedent set, and are private German manufacturers to lose their plant and see their means of livelihood destroyed? If this is done, such acts become sanctioned by international use as part of the unwritten codes of belligerents. At the same time, it may be difficult or impossible to exact reparation in any other manner from a country exhausted by war. To give another instance. Belgian prosperity has resulted partly from its excellent system of tramways arranged to facilitate internal traffic; and the German authorities have in many places torn up the rails for military purposes in Russia. This affects not individuals, as in the instance referred to, but whole commercial communities, and a just and fitting retribution would seem to be to replace the stolen Belgian rails by similar material from Cologne and other German centres. If adequate compensation in the shape of a direct indemnity is impossible, we hope it will be feasible to exact an equivalent in kind for such ruthless acts of robbery which form so many proofs that Germany has separated herself from European civilization as completely as though she belonged to some other planet.

The New Strathcona School, Vancouver, B.C.

THE latest addition to Vancouver's educational buildings is the new Strathcona School, at the corner of Jackson and Pender Streets. The building is of reinforced concrete construction throughout. The exterior walls are of red hydraulic pressed brick and Haddington Island stone. While the building was being erected tests were made of the reinforced concrete floors. Two class-rooms on the ground floor were selected, and each was weighted with an equal test-load of 56,700 pounds. The deflection was five sixty-fourths of an inch.

The new Strathcona School at the corner of Jackson and Pender Streets, Vancouver.

The building is constructed upon the sixteen-room plan, and, while it contains only eight rooms, it presents an absolutely finished appearance. The School Board can make an eight-room addition economically at any time.

The roof is covered with Portmadoc slate. The rooms are made light and cheerful by the large amount of glass in the building. The heating and ventilation are the Plenum system combined with a mechanical system. All the ducts and registers were calculated with low velocities to develop two thousand cubic feet of air per occupant. Special attention has been given to air diffusers and the placing of registers, so that a complete diffusion of air within each room is assured. Low pressure steam is used as a medium for heating with oil fuel, all apparatus being automatically controlled.

The total cost of the building was $81,700. The contract was signed in July, 1904, by W. S. McDonald, whose tender was $66,871. A separate contract for the heating and ventilating was awarded the Canadian General Fire Extinguisher Company of $14,405. The following firms had sub-contracts: Dixon Bros. & Schultz, excavation; Bogardus, Wickens & Company, plain glass; Vancouver Stained Glass Company, ornamental glass; J. Wartman, plastering; Cedar Cove Sash & Door Company, interior trim and cabinet work; Lewis & Sills, hardware; National Iron Works, ornamental iron; Raecolith Flooring Company, composition floors, halls and stairs; Campbell & Murray, painting; Barker Cruse, vacuum system; Jarvis Electric Company, electrical work; W. N. O'Neil, tile and terrazzo; Barr & Anderson, plumbing; B. C. Sheet Metal Works, metal and tin work; Gawne & Daly, metal air ducts; Downing Bros., pipe covering; Fess System of Canada, oil burning plant.

In the concourse of the express level of the Grand Central Station, New York, the old City Hall of that city could be placed with 28 ft. to spare at either end and 1 ft. clear on each side. The top of the statue that rested on the dome of the City Hall would be about 15 ft. under the ceiling. The number of passengers handled annually increased from 15,750,000 in 1903 to 20,800,000 in 1911 and to 23,600,000 in 1914. In 1905 982,000 cars entered and left the station, in 1910 1,141,000, in 1913 1,227,700, and in 1914 1,126,000. They were, respectively, made up in 207,800 trains in 1905, 189,000 in 1910, 200,500 in 1913, and 182,500 in 1914. The decrease in the number of trains is due to more cars being used on the trains in consequence of the employment of heavier electric locomotives, and to longer multiple-unit trains. As a matter of interest and as revealing the love for statistics to be found in the United States, it may be said that in 1905 there were handled 1,716,000 pieces of baggage, in 1910 1,765,000, and 1,804,000 in 1913.

Proper Road Location: Its Importance and Effects

By William R. Roy*

THE purpose of a highway is to carry traffic. The traffic will naturally vary with the district which is producing or attracting traffic; so the first consideration of the locator, in the broadest sense, will be the district to be served. It may be said that the districts requiring highways fall naturally into three classes, which may be designated as urban or residental districts, scenic districts, and agricultural districts. On account of the fact that these classes necessarily overlap in many cases, the distinctions indicated have their greatest effect upon the location of highways, rather than upon the details of construction, where a broad-gauge general policy is to be followed by the executive charged with highway administration.

In referring to urban or residential districts, I have in mind the suburban areas which are adjacent to most of the large cities of this country, with at least a fairly "well-to-do" population, able to own comfortable homes and to pay for the extra transportation required by the greater distance to the business centres. Such a district both produces and attracts traffic. The original development of such districts was made possible by the electric railway; the highways were of secondary importance. Now the small motor vehicle has become the important factor in transportation, and the development of highways has become of first importance. The traffic produced by such a district will be almost exclusively comparatively light passenger vehicles, with ample power to climb any gradient even up to 20 per cent. The hauling which the district requires will be confined to materials for the construction of new residences or other buildings, and such heavy supplies as fuel. The locator therefore will have as his first consideration what may be called the accessibility of the highway, and safety of the traffic. He will not be confined to a narrow range of gradients, but will endeavour to find a proper middle ground between the extremes of grade and cost of construction. In locating a highway for the residential development of a previously unoccupied district, the engineer has his greatest opportunity. The proper location will involve plans for connecting drives to the main artery; consideration of the future requirements of the community for sewerage and storm drains; the disposal of surface water; intersections of existing or contemplated railways; and the possibility of snow blockades in winter. As in most cases the cost of such a highway must be considered an eventual charge upon the property of the district, the choice of proper location is too frequently restricted by that cost; but the attitude of the public toward this factor is improving with the increasing demand for safety of traffic.

The location of highways into scenic districts brings with it a set of problems which are pre-eminently of an engineering nature. The purpose of such highways is to afford access to districts of natural beauty. The choice of routes may be influenced by the existence of attractive camping grounds, in addition to the principal points of interest which are to be reached. The only restrictions placed upon the engineer are those of expense and safety of travel. Another consideration, which is rapidly becoming of first importance with the extension of this type of highways, is the cost of maintenance. This is particularly true in the mountains of the Pacific Coast, where conditions of soil, drainage, and snowfall have a vital bearing on upkeep costs. Gradients as high as 8 or 10 per cent. may be utilized in order to keep the cost of construction within reasonable limits, but these gradients should be reduced on sharp curves in the interest of safety. The importance and effects of proper location will be seen in the resulting popularity of such highways, and in the much talked of development of our natural resources.

Problems of a somewhat different type are encountered in planning highways for a large farming district of a flat or only gently rolling topography, where the farms are held in large units and the population is scattered. The prevailing systems of roads usually follow the subdivisional lines. The traffic will be heavy at certain seasons of the year only. On account of local prejudices, it is often very difficult to select any highway, or system of highways, for extensive improvement. With existing highways on the rectangular system, it is seen that a farmer living eight miles in an air line from town, may have to travel from nine to twelve miles along the section lines to reach his market. The ideal system for such a district would be a combination of the rectangular method with diagonal arteries radiating from the markets.

Existing roads in the thickly settled agricultural and industrial districts in the United States are also frequently laid out on the rectangular system, and in addition have been fenced up to narrow limits. Such a system can not often be used to best serve the modern requirements of the entire community, especially in a district devoted to truck gardens and dairy interests, where the bulk of the heavy hauling is fairly constant throughout the year. The location of a great trunk highway through such a district, and connecting industrial centres, should be along the principles long established for the location of railways, with the modifications due to the permissible maximum gradients. The short-haul transportation of heavy commodities to the nearest suitable market or point of rail shipment is the important consideration. It is a generally accepted rule that the maximum gradient of such highway should not exceed 5 per cent.; and curves should be planned to afford a sight distance—that is, the greatest distance at which the drivers of two approaching vehicles may see each other's machines along the road—of not less than 250 feet.

In a country of rolling topography, with frequent stream crossings and railway intersections, the route which the engineer recognizes as the best location will almost invariably cut through highly developed property. The right of way for such an improvement will usually have to be obtained at high figures, both in the value of land taken, and in damages to the property thus divided. While this cost often seems prohibitively high, it must be recognized as being what we may call a "capital charge." Here again one is struck by the resemblance between the fundamental principles controlling the location of a railway and those which should control the location of a great industrial highway. While it may be somewhat foolhardy to attempt to predict future developments in short-haul transportation, the conditions which have arisen during the past six years may indicate, in some measure, what may be expected; and may be taken by the locator as his guiding considerations in selecting a route for a new highway or in improving the route of an existing highway. In the same way, is it not true that the development of the great railway systems may afford much counsel to any community in planning the size of the financial investment that should be made in a new highway? I refer particularly to the financial investment in rights of way, grading costs, and stream crossings, rather than to the surface structure of the highway.

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*State Highway Commissioner of Washington.

This brings us to the consideration of operating costs, and the influence that these costs should have in the locator's selection of a route. There are very few published data on the actual costs of motor vehicle operation, or the effects of grade and curvature upon these costs. This subject should be a fruitful field for investigation by our highway departments and technical schools. However, it is a self-evident fact that more power is required to move a motor truck up a 5 per cent. grade than over a level grade, or even one of 2 or 3 per cent. Also, it is probable that every person who has driven a motor car has noticed that a curve in the road on a 5 per cent. grade will very appreciably increase the amount of power required to climb that gradient as compared to the power required to climb a similar gradient on a tangent. As the number of vehicle units increase, it must be evident that operating costs become of more and more importance in the matters which the highway locator has to consider.

To any person who thinks that the effects of grade and curvature on operating costs may be disregarded by the locating engineer in planning a highway of the type referred to, as being too finely drawn for present consideration, I wish to cite certain conditions which have developed in many sections of the Pacific Coast in recent years. No doubt similar conditions exist in all parts of the country, but I refer specifically to the Pacific Coast on account of personal observation of these conditions. We have many fertile valleys, capable of intense cultivation, which are closely settled, at least in the vicinity of the larger cities. These districts produce large quantities of vegetables, fruits, and dairy products—all commodities requiring prompt transportation throughout the year. In past years these commodities have been hauled by the electric railways. Following the construction of improved highways, or at least improved surfaces, there has grown a formidable system of motor vehicle transportation, carrying both freight and passenger traffic. In handling freight, these motor vehicles collect produce practically at the farmer's gate, and deliver it to the door of the commission house or butter factory in the city, at the same freight tariff formerly paid to the railways, and with the elimination of the drayage charges at either end of the haul. A similar condition exists in the short-haul transportation of passengers. There have been placed in profitable operation many lines of large capacity passenger automobiles, which pass close to the farmer's door, and which will carry him to town quickly and conveniently, and at a reduced rate over the former passenger tariffs on the electric or steam railway lines. Probably no better example could be found of the truth that increased convenience in transportation will result in increased volume of transportation. This increased traffic in turn has produced more problems for the highway officials and locators. The highway that was built a few years ago, with the grades and curvature that seemed to the locator to be justified by existing traffic conditions and topographic obstacles, is now intolerably crooked, and the grades are too steep.

These conditions have been evident for some time to those officials charged with highway maintenance; at least we have heard the most about them from such officials through the medium of the technical press and from the platforms of association meetings and conventions. Is it not probable that at some not far distant time we shall begin to hear from the owners of motor vehicles about the cost of operation?

On going into this subject, the engineer finds that the proper location of the heavy-traffic, year-around highway involves consideration of factors which have long been prime essentials in the best railway location, but which have not been supposed to be worth taking into account in planning a highway. Among these factors may be cited, in addition to the matters of grade and curvature already mentioned, the necessity for stopping and starting heavy motor trucks to pick up and discharge freight and passengers; intersections with cross-roads where the average speed may not be maintained; and the necessity for widening of the traveled way as the volume of traffic increases.

How Did You Die?

Did you tackle that trouble that came your way
With a resolute heart and cheerful?
Or hide your face from the light of day
With craven soul and fearful?
Oh, a trouble's a ton, or a trouble's an ounce,
Or a trouble is what you make it,
And it isn't the fact you're hurt that counts,
But only, how did you take it?

You are beaten to earth? Well, well, what's that?
Come up with a smiling face.
It's nothing against you to fall down flat,
But to lie there—that's disgrace.
The harder you're thrown, why the higher you bounce;
Be proud of your blackened eye!
It isn't the fact that you're licked that counts;
It's how did you fight—and why?

And though you be done to the death, what then?
If you battled the best you could,
If you played your part in the world of men,
Why, the Critic will call it good.
Death comes with a crawl, or comes with a pounce,
And whether he's slow or spry,
It isn't the fact that you're dead that counts,
But only, how did you die?

—Edmund Vance Cooke.

System in Highway Accounting

By S. D. Gilbert*

THE first essential in building up a system of highway accounting is a thorough and comprehensive knowledge of what is to be accomplished, together with a complete understanding of the laws governing the work and its adaptability to them. The assistance of expert accounting knowledge to build the framework of such a system may be used to advantage, but as the system is applied to the work in its operation, if it is to be practical and produce the best results, it must be made adaptable by actual application, and unless it is, it is not possible to estimate the disadvantage. The system must not only meet the requirements of the department, but also must be in unity and work smoothly with the accounting department of the state comptroller, where the final audit is had. Every department will have a large number of live appropriations at one time, from which expenditures are being made, and unless the accounting system of the department is in close relation to that of the comptroller, confusion and error are bound to follow.

The individual highway account should begin with the initial survey and should show the identity of the highway by name or number, preferably both; the country and town wherein located; its length; the type of construction; the date of the contract; the amount, and the contractor's name; if a country road, the percentage to be paid by the state and by the county. As the account progresses it should show the cost of engineering and advertising; amounts paid to the contractor and from what source or appropriation; and when finished, the final distribution of cost between the state, county, town, or city. On account of construction being carried on under contract in most cases, the construction accounting cannot give as much detail of the highway history as the maintenance and repair accounting. The original specification of the highway and the monthly estimates which are paid on it, however, will furnish the information in the detail necessary to complete the construction history.

In maintenance and repair accounting, greater detail can be had and should be required, for the reason that this work is not as uniform as construction and shows a wide variation both as to cost and as to type of work from year to year, so that this branch of accounting should give every possible detail of maintenance work on a highway in order to provide intelligent information in the future. This, of course, must necessarily be based upon the requirements of the department. Some of the subdivisions which should appear in the maintenance accounting of a highway, which are descriptive of the work done, are the following:

Whether the highway is a state or county highway;
Its name and number;
The county and town within which it is located;

A sub-division of disbursements under the headings:—Improvements; Resurfacing; Engineering and inspection; Ordinary repairs to highway surface; Labour or material; Cleaning macadam; Trimming shoulders; Opening ditches; Repairs to paving; Oil—Cost of spreading and applying—Material for covering; Repairs to guard rail; Repairs to concrete; Tools and plant; Patrol, if a patrol system is employed; Extraordinary repairs.

To these suggested subdivisions others could be added as found necessary, which will give the desired detail as to the important items of cost, with the result that from year to year a comprehensive analysis of maintenance and repair work is being constructed that not only applies to the whole system, but to the individual road, which is most important.

All construction eventually resolves itself into maintenance and repair, and unless a state continues to make appropriations for construction, construction accounting gradually disappears, and with its disappearance maintenance and repair accounting increases in proportion and remains, as it is not conceivable that a state will abandon its investment in good roads, and it therefore must continue to make appropriations for their maintenance and repair. In order that this maintenance and repair may be carried on economically and intelligently, the work of previous years must be thoroughly reviewed as to the type of work which was done and its cost as related to the individual road, so that the type of work may either be continued from year to year, or changed according to its efficiency. In no other way can this information be obtained except from a properly analyzed and accurately prepared accounting which will give the intelligible information necessary, and which, if it is available, will result in saving the state large amounts of money by avoiding those types of work which have proved themselves inefficient and expensive.

It is extremely easy to get information from the usual accounting as regards the whole situation of disbursements. It could easily be shown that the maintenance and repair of a certain highway for a certain year costs a certain amount of money, but unless the account has been built up from day to day in the manner suggested above, it will be very difficult at some time in the future to find out just what kind of work was done on the individual highway, what the analysis of its cost is, and whether from this analysis the service received from the type of work indicated warrants its continuation.

It is my experience that the most adaptable method of supporting this suggested accounting is that of voucher payments, so that the voucher representing each individual payment will show the complete distribution of that payment to the different items entering into the account. When the voucher is entered, the distribution is made, and it is completely absorbed, with the result that the account shows the analysis of the disbursements and is supported directly by the voucher in the file.

By using the voucher system a great deal of detail is avoided, and I would strongly advise that the keeping of personal and merchandise accounts should be omitted, as in highway accounting it is not imperative as to how much material has been purchased from a firm or individual, but it is important as to how much the material cost on a certain highway. If the total purchased is desired at any time, it can easily be arrived at from the vouchers in the files, which show all individual payments. By doing this a large amount of useless bookkeeping can be avoided and better results obtained.

In devising a system of accounting it is impossible to foresee the demands which will be made upon it in the future for information and the tests to which it will be put. The only protection, which a department can have, is that the accounting system should be built up from the first with the view of giving the public as complete information as possible and in as great detail as is practicable for the purpose. If this is done, when the test comes it can be met promptly and accurately.

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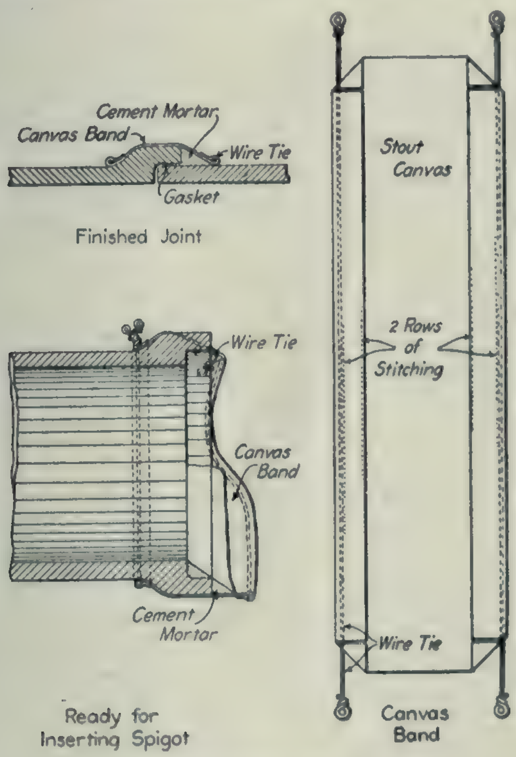
* Auditor, New York State Highway Commission.

No system can be outlined completely at the beginning, for the reason that the details of the work constantly change, and the system in order to be practical and up-to-date must change with it and adapt itself to it. By all means avoid ruts. Because certain features of the system were adaptable last year, it does not necessarily follow that they will be this year. Anticipate what the work requires and meet these requirements promptly.

Mortar Joint Laid with Canvas Band in Wet Trench

By D. H. Fleming[*]

THE canvas band and the method of using it shown in the accompanying drawing have enabled good cement-mortar joints to be made in sewer pipe laid in wet trenches. The stout canvas band is a few inches longer than the circumference of the bell of the pipe, and is of sufficient width to completely envelop the bell and its mortar joint. A small pliable wire is inserted between the double stitching along each edge, and is looped at each end to avoid its coming out. The band is fastened around the bell of the last pipe laid by twisting up one of these wires. This is done with each section of pipe before lowering it into the trench. The joint is made in the usual manner with the gasket and cement-mortar, the lower half of the canvas band being filled with mortar as well as the invert of the bell. After the spigot end of the next length of pipe is in place, the second wire tie is fastened around it. This draws the band up tight around the joint, and prevents water in the trench from washing the cement out of the mortar joint.



Canvas band protects cement joint.

The joint protector is not withdrawn, but remains as a permanent part of the construction. It was devised and used with great success by Mr. E. R. Gray, at the time he was District Engineer in the Sewer Section of the Department of Works, Toronto. Mr. Gray is now Chief Assistant City Engineer of Hamilton.—Engineering Record.

The Uses of Slate

IN a recent contribution to Stone, Mr. J. S. Grasby, the well-known geologist, discusses the uses of slate. He says that most people have the impression that it is used wholly for roofing, but this is, of course, wrong. He classifies it according to its use for roofing, structural or electrical purposes. That used for the last two purposes is in the form of slates varying from a little more than the thickness of ordinary roofing slate to an inch or several inches and more in thickness. "The reason why the superiority of slate is not more widely known," says the writer, "is because the slate operators are not nearly so progressive in the matter of advertising as they ought to be."

After entering into the advantages of slate as a roofer, its durability, non-inflammability, resistance to fire and lightning, its cheapness compared with artificial roofings, the writer discusses its increasing use for structural purposes. Milled slate is used in large quantities in a large proportion of up-to-date modern buildings for stair-treads, hearths, mantels, floors, flagging, base boards, lavatory, fire-proof partitions, etc. The demand for these purposes is not only due to its durability, strength and cheapness, but because its substitution for wood-work diminishes liability to fire and results in reduced insurance rates.

Besides the uses enumerated above, it is in demand for laundry-tubs, kitchen sinks, well and chimney caps, school slates, vats, school blackboards, billiard tables, laboratory and kitchen taps, flour-bins, dough troughs for bakeries, sanitary ware, refrigerator shelves, trimmings, etc. It is also used for tombstones, grave linings, vaults and memorial tablets.

Still another use of structural slate is for the production of imitation marble. This marmorisation is accomplished by applying a porcelaneous glaze ranging from uniform white or tinted to being streaked with suitable pigment in imitation of various colours and patterns characterizing marbles. This product is said to be superior to the genuine thing itself because of its greater tensile strength, its property of being non-stainable and its capacity for high polish. It is, of course, much cheaper than marble, and where economy is desirable, is an excellent substitute for it.

Electrical companies use a great amount of slate, for its superiority over other materials for use as switchboards and other electrical purposes is everywhere recognized. For it to be effective, however, is must contain little magnetite, and the slabs and pieces used must be free from metallic veins. A slate uniform in colour is preferred and it should be capable of being drilled or sawn without scaling off. The presence of magnetite greatly lowers the insulating value of slate, and the presence of a high percentage of this mineral excludes slate from use for electrical purposes.

A Pennsylvania firm constructed several hundred ovens in 1910, using coke breeze as an aggregate. This work is reported as satisfactory, although the company claims that concrete made with coke breeze should not be placed too near the heat, as the coke has a tendency to burn out and disintegrate the concrete.

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[*] Assistant City Engineer, St. Catharines, Ont.

Personal Mention

Mr. W. B. Redfern, Town Engineer of Steelton, Ont., has resigned.

Mr. T. R. Case has been appointed Assistant General Manager of Steel and Radiation, Limited, Toronto.

Mr. H. B. Sims, of the British Columbia division of the C. P. R. engineering staff, has obtained a commission in the Canadian Railway Construction Corps.

Mr. C. H. Fullerton, of New Liskeard, has been appointed Superintendent of Colonization Roads in Ontario—an office formerly held by Major W. H. Bennett, who was killed at St. Julien.

Pro Patria

MAJOR Thomas C. Irving, Junr., of Toronto—known to a wide circle of friends as "Tommy" Irving—left the Queen City on the outbreak of war in command of the Second Field Company of the Canadian Engineers. For some time now he has been serving His Majesty "somewhere in France," and it is gratifying to be able to report that, while the name of his unit has appeared quite frequently in the casualty list, he himself has come through safely so far. It was known some time ago that he had been recommended for his Majority, and a cable confirming the step in rank has just been received.

Major T. C. Irving, Junr.

"Tommy" Irving fitted himself for the complex duties of active service by a varied experience in professional and business life. He received his technical education at the Faculty of Applied Science of the University of Toronto and in the Engineering Department of McGill University. Previously he had spent some years with F. H. Clergue at Sault Ste. Marie during the construction of the Algoma Central Railway.

With his varied experience Major Irving returned to Toronto and organized the Standard Inspection Bureau, which later became amalgamated with the old firm of Robert W. Hunt & Company, Chicago. Major Irving became Vice-President and Manager of the new company. Latterly he had interested himself actively in the problem of electric smelting. Having organized the Moffat-Irving Steel Works, Limited, he erected a new type of electric furnace, which has now been in successful operation for two years. Volunteering for active service at the outbreak of the war, he had to postpone important experiments which may be of revolutionary interest in steel-making.

That Major Irving's activities were not restricted to his own personal undertakings is well known: he was always ready to identify himself with matters looking to the advancement of his profession—in which respect the Canadian Society of Civil Engineers is considerably indebted to him.

Major Irving is one of the three sons of Mr. T. C. Irving, Senr., General Manager of Bradstreets. All three are with the Colours. The other two are Pte. W. P. Irving, of the 3rd Battalion of the First Infantry Brigade, and Gunner H. G. Irving, of the Ammunition Column, 3rd Artillery Brigade—both of whom, like their brother, went away with the first contingent.

The late Sir Sandford Fleming left an estate valued at $238,534.

Mr. W. A. Adam, of the Lethbridge city engineering staff, has been gazetted a provisional lieutenant in the Fourth Field Company, Canadian Engineers.

Mr. H. C. Leverick was re-elected Chairman, and Mr. H. D. Mathias Secretary, at the annual meeting of the Regina Branch of the Society of Sanitary Engineers of Western Canada.

Mr. W. H. Boughner, of St. Thomas, has obtained an appointment on the engineering staff of the city of Port Arthur at a salary of $3,500. Mr. Boughner is a native of St. Thomas, and a graduate of Queen's University.

An illustrious name to be added to the honour roll of engineers who have given up their lives in the war is Lieut. Raymond Lodge, son of Sir Oliver Lodge. The late Lieut. Lodge held a commission in the South Lancashire Regiment, and was killed recently in Flanders. He was twenty-six years of age.

Mr. Allen Hazen, the well-known New York consulting engineer, was a recent visitor to Victoria, B. C. Mr. Hazen was accompanied by Mr. Nelson Baker, of the editorial staff of the Engineering News, and Mr. J. Elliott, engineer of the Spring Valley Water Company. The party had been in San Francisco on consulting work in regard to the water supply.

Regina Engineering Society

At the fifth annual meeting of the Regina Engineering Society, held recently, it was decided to amalgamate that body with the Regina Branch of the Canadian Society of Civil Engineers. Officers were elected as usual, Mr. L. A. Thornton becoming President; Mr. R. M. Blackburn, Vice-President; Mr. O. W. Smith, Second Vice-President; Mr. J. M. McKay, Secretary; Mr. J. R. Ellis, Treasurer; Mr. D. W. Houston, Librarian; and Mr. W. R. Harris, Corresponding Secretary. In his presidential address Mr. Thornton, who is City Commissioner of Regina, dealt with the place of the engineering profession in the life of the community. He expressed the opinion, after looking over the list of officials holding Government and municipal offices throughout the Dominion, that the engineering profession was not represented as well as it should be in the public life of Canada. As an instance of the importance of engineering skill in human activities, Mr. Thornton referred to the present war, which, he said, he regarded principally as an engineering struggle.

Excellent progress is being made on the construction of the great concrete aqueduct which is being built for the Greater Winnipeg Water District. The Chairman of the district, Mr. S. H. Reynolds, states that some sixteen miles of the aqueduct will be finished by November 1. The entire length of the aqueduct will be ninety-four miles. The work has only been in progress since last spring.

Plant of The Dominion Sheet Metal Company, Limited, Hamilton, Ont.

Mr. A. T. Enlow, President Dominion Sheet Metal Company.

Galvanized Sheets Now Made in Canada

THE new all-Canadian plant of the Dominion Sheet Metal Company, Limited, Hamilton, Ont., which has been in operation since September 1st, is capable of handling 150 tons of metal sheets a day. The present output is sixty tons daily, operating on a 24-hour basis. This showing is all the more creditable when one considers that the sale of galvanized sheets this year is necessarily restricted, owing to the difficulty in obtaining zinc spelter, which is being used so largely for munition purposes.

In normal times, nearly 70,000 tons of galvanized sheets yearly are used in this country. Prior to the establishment of the Dominion Sheet Metal Company's plant at Hamilton, **not one pound was made in Canada,** the bulk of the supply having been imported from the United States, and a portion from England.

The President and General Manager of the company is Mr. A. T. Enlow, a man of life-long experience in the sheet metal business. Mr. Enlow was formerly in charge of one of the largest sheet metal plants in the United States, and was also actively associated with another plant having an exceedingly good reputation in the States. In addition to this, Mr. Enlow has also had a thorough experience in the manufacture and distribution of products made from galvanized sheets, and is therefore peculiarly fitted to utilize his knowledge in the coating of metal sheets that will be adapted for Canadian uses.

Mr. Enlow saw his opportunity, and grasped it—with the result that to-day we have in Canada a sheet metal plant the equipment of which is the last word in efficiency and modern design.

The location of the plant, on the belt line railway jointly operated by the G. T. R., C. P. R., T. H. & B., and M. C. R., and within sight of the shipping docks on Lake Ontario, is such that this company can receive, convert and re-ship without delay.

The water supply is pumped from Lake Ontario. Natural gas is used for fuel, and the temperature is controlled by electric pyrometers, ensuring the application of the coating at the proper temperature. Hydro-electric power is used throughout the plant, and electric speed controllers have been installed.

The product is known as "Premier" galvanized steel sheets. The "Premier" trade-mark has been adopted as being distinctly Canadian, and the firm has received a letter from Premier Borden acknowledging the galvanizing of the first sheet turned out in Canada, and expressing his appreciation of the compliment implied in the selection of this name for the company's trade-mark.

The essential requirements of a good galvanized sheet are first, a basic sheet of proper composition and texture, and second, a pure coating, properly applied. The so-called "Black" sheets, from which "Premier" galvanized sheets are made, are specified from certain mills having a reputation for quality, and must conform to physical and chemical analysis.

Lage stocks of black sheets and a fair amount of gal-

Loading and unloading—all under cover.

Cooling wheel. Inspecting finished sheets.

vanized sheets are always carried, but it is the company's aim to galvanize large shipments to order, so that sheets will reach the customer fresh and bright, as compared with the damaged and unsightly condition in which they are frequently received when shipped from long-standing stock.

In addition to the regular quality "Premier" galvanized sheets, the company also turn out a special "tight-coated" "Premier" galvanized sheet, when desired. This is especially useful for purposes requiring extreme forming and seaming.

Pickling department.

All "Premier" sheets are inspected three times in the process, and every sheet that is not entirely satisfactory is set aside and sold as a "second." These "seconds" are never branded; the only sheets receiving the "Premier" brand are those which are first-class in every respect.

The galvanizing process itself is most interesting. The black sheets are first unloaded on trucks and weighed. They are then placed on stock piles, by an electrical crane. From these they are removed, one by one, and carefully inspected before being placed in the "pickling crates" which are made of nickel or "monel" metal. Each crate, as soon as it is filled with perfect black sheets, is picked up bodily by the electric crane, and placed in a tank containing hot acid, remaining in the acid until all scale and surface matter has been removed from the surface of the sheets. The crane then removes the loaded crate from the acid, and transfers it to a wash tank, through which clear water is flowing profusely. When thoroughly washed, the loaded crate is placed in a storage tank of clear water, until required, when it is again lifted by the crane and put into the feed tank, after each sheet has been inspected for imperfect pickling. From the feed tank the sheets are fed singly into the molten metal bath, galvanized, and run through a double roller leveller while still hot. This roller leveller carries each sheet up to a chain conveyor, which carries it along to the automatic cooling rack. As soon as the sheet strikes the air the smooth, silvery surface takes on the "spangled" appearance which distinguishes all galvanized sheets. When cool each sheet is carefully inspected on both sides for the slightest imperfection.

Black sheet warehouse, showing electric crane.

The Dominion Sheet Metal Company make a specialty of shipping orders quickly, either by carload or less. They have special facilities for ordering and receiving raw materials without delay, and this enables them to make quicker shipments than could possibly be secured outside Canada.

News and Notes

The annual meeting of the Ottawa Branch of the Canadian Society of Civil Engineers was held in the Board Room of the Commission of Conservation on October 14.

The Montreal Board of Control have decided to extend to the end of the year the leave of absence of Mr. G. Janin, City Engineer, who is at the front. He is allowed a third of his salary.

The Montreal Builders' Exchange and the Master Plumbers' Association have raised over four hundred dollars for a patriotic fund which will be donated to the Khaki League Convalescent Home for Soldiers.

The estimated cost of Toronto's new Union Station, according to plans submitted to the City Architect of Toronto by the Toronto Terminals Company, is $3,340,000. The original estimate was three million dollars.

The Canadian McCall Incinerator Company, Limited, has been incorporated with a capital of $300,000. The incorporators include Frank Denton, J. I. Grower, and E. J. MacEwen, all of Toronto. The head office will be in Toronto.

The Raymond Construction Company, Limited, Toronto, have been taking tenders for all trades required in the erection of the Booth Memorial Home. This building, for which Brigadier G. Miller is the architect, is to be erected by the Salvation Army at a cost of $150,000.

The Canadian Seigwart Beam Company, Limited, of 103 St. Francois Xavier Street, Montreal, carried out the work of reinforced concrete floors, roofs and fireproofing of the fire station and recorders' court at Maisonneuve, Que., described in our issue of October 6th.

A Municipal Officers' Association has been established at Fort William, Ont. The objects are to encourage a study of the principles of municipal government and to promote the interests of its members. The Secretary is the City Engineer of Fort William, Mr. R. R. Knight.

Mr. H. R. Stafford, Chief Engineer of the Grand Trunk Railway, accompanied by officials of the Maintenance, Operation and Construction Departments, is on an inspection trip over the company's lines. An observation car which has been specially constructed for this trip is fitted with electric indicators and other appliances for recording the conditions on the journey.

The Town of St. Lambert, P. Q., has let a tender for ornamental street lighting to G. M. Gest, Limited, Montreal, at $4,250. The single nitrogen filled lights of 350 watts will be mounted on ornamental poles, 12 feet high from the base to the centre of the light. The wires will be carried in conduits already constructed. The price includes the wires. Mr. E. Drinkwater is the town engineer.

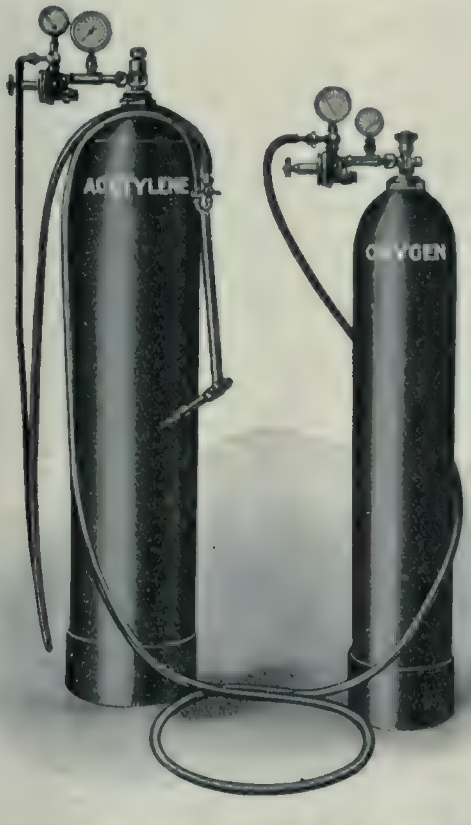
Public works voted by the civic administration of Montreal during the present year represent an expenditure of nearly five and one-half millions, according to a report prepared for one of the controllers, Mr. Cote, who wishes to demonstrate that the Corporation has done its best to continue "business as usual." Most of the expenditures have been in the way of permanent paving and sewer work.

Bulletin 9X, issued by the Pawling & Harnischfeger Company, Milwaukee, Wis., describes and illustrates the "P. & H." power traction backfiller, its construction and application. This is strictly a one-man machine. With its adjustible jib, it accommodates itself to various kinds of trench work. Backfilling has always been one of the most troublesome and expensive operations for contractors engaged in sewer, water, or other trench work. The "P. & H." would appear to be the solution.

Oxy-Acetylene Cutting and Welding

Illustrations by courtesy of L'Air Liquide Society —Montreal, Toronto, Winnipeg

A few years ago the oxy-acetylene cutting and welding process was introduced in Canada. It found approval at once, and many leading concerns in the metal trade adopted it for many kinds of repairs and manufacture. Later on, medium-sized and smaller concerns followed, and nowadays the enormous advantages of the process are frankly admitted.



Portable oxy-acetylene cutting plant. By adding a welding blowpipe this plant can be used for welding.

In the following paragraphs a few details will be given regarding oxy-acetylene cutting, with special reference to the contracting business.

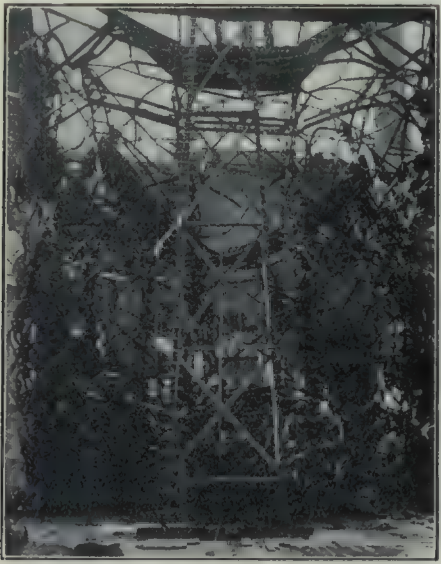
What is oxy-acetylene cutting? It is the rapid and clean cutting of steel and iron (except cast iron) by means of an oxygen jet thrown on the red hot metal, through a specially constructed blow-pipe, which also does the heating of the metal. The apparatus itself—if it is of the portable type, as mostly used for outside work—consists of two tanks—one containing compressed oxygen (weighing about 100 lbs.), and one containing dissolved acetylene under pressure (weighing about 175 lbs.), plus two pressure-reducing valves and a blow-pipe with tubing as connections (these latter parts weighing about 25 lbs.). There are no difficulties at all in moving this plant, and very often a small truck is used for transporting. The plant can easily be lifted, if required—for instance, in one of the upper storeys of a skyscraper under construction. This equipment is a very compact one and forms a unit in itself. Its price—gas separate—varies from $100 to $175 for cutting. Stationary plants—not portable—are also on the market. In these plants, the acetylene gas can be made in a suitable generator. This, however, proves to be too cumbersome and too heavy for outside and emergency work, where, as a rule, quick shifting about is absolutely necessary.

The main advantages of this process are the following: rapid work; much quicker and cheaper than hand sawing, air drilling or chiseling even on hard steel; adaptability at places which cannot or hardly be reached with a saw, drill, or a chisel; easy operation—as only a comparatively small blowpipe is to be handled instead of a heavy saw, sawing machine or tool, which could not be transported so easily. Even in the factory, in many cases, the cost of bringing a heavy and bulky piece to the shears is higher than the cutting with the blowpipe. There is also the advantage that the piece has not to be shifted. To give an idea of the power of the oxy-acetylene flame it might be stated that steel blocks 22 ins. thick have been cut through, quick and clean, in a very short time. The speed is figured at about 1 foot a minute in steel plate ½ in. thick, and ½ foot a minute in steel plate 2 ins. thick, depending somewhat on the state of the material, whether rusty, covered with paint, scale, etc. The moderate expense for gas used for cutting is favorably counterweighed by the speed and convenience of applying the process. The cost of making a cut 10 ft. long in ½-in. steel plate (any shape of cut—straight or curved) is approximately 70 to 75 cents—labor included. The gas cost is generally based upon the number of square inches contained in the section to be cut —i.e., a cut 100 feet long in ¾-in. plate means 900 square inches section. About 1 cent to 1¼ cent of gas is needed for 1 square inch section.

Here are just a few examples to illustrate the numerous applications of oxy-acetylene cutting in the contracting and similar lines. The old Quebec Bridge was scrapped by means of the blowpipe, and so was the old Don Bridge at Toronto. Many wrecks of iron ships were removed by this process and profitably sold as scrap. The wreckage after the fire of the St. John the Baptist Church at Montreal—a wreckage which presented a huge mass of tangled beams and girders—was rapidly and neatly cut to small pieces, for quick removal, with the blowpipe. This enormous wreck was completely removed within five weeks. Two cutters and one helper were employed. With an air chisel and with saws, the job was estimated to last about six months.

Dozens of old boilers have been cut into small pieces and removed from the building without tearing the surrounding walls down. In hundreds of cases of emergency the cutting blowpipe has been employed with full success. Only a few weeks ago, the blowpipe was applied at Chicago to cut holes through the sides of the capsized "Eastland" in order to gain access to the inside. During fires, in structural steel buildings, the blowpipe has helped many a time to remove material blocking the way, and ½-in. iron bars on the outside of the windows of buildings have been cut through at the rate of twenty a minute. The quick cutting of beams to exact length with the blowpipe, in structural steel work—at the erecting place—means quite a saving, and so does the rapid piercing of holes in beams for passing bolts, pipes, etc., at places where it would be difficult to clamp a ratchet. Rivet heads are speedily burnt off; old beams in concrete work are cut at places that cannot be reached by a saw or chisel; plates of any kind or shape are cut from rectangular plates outside the shops—all with the oxy-acetylene blowpipe.

These are just a few examples, but, of course, there are many left. In fact, the oxy-acetylene cutting process is nowadays considered as indispensable by many contractors.



Wreck of St. John the Baptist Church, Montreal. Cleared in a few weeks by the cutting blowpipe.

Oxy-acetylene welding will be discussed in a later issue.

Canadian Society's Programme

At the first meeting of the Canadian Society of Civil Engineers, Montreal, at which Mr. R. F. Haywood read a paper on the Stave Falls Development of the Western Canada Power Company, Mr. Walter J. Francis, the chairman, outlined the programme for the new session. The papers to be contributed will cover a very wide range of engineering activities, and will include subjects of great interest to the profession. Questions affecting submarines are just now of importance, and a paper on this subject will be read by Mr. P. L. Miller, General Manager, Canadian Vickers, Limited. Messrs. H. Holgate, R. M. Wilson and J. C. Smith, who were responsible for the design of the Cedars Rapids power plant, will contribute a joint paper on this work. Mr. C. M. Morssen, of the Atlas Construction Company, will talk on "Heavy and Special Reinforcement Concrete Work in Buildings," while other promised papers are by Messrs. S. P. Brown, A. Stewart, and W. C. Lancaster, "Mount Royal Tunnel;" R. H. Parsons, "Street Railway Electrolysis"; L. M. Jones, "Port Arthur Waterworks"; J. L. Busfield, "Railway Terminals"; A. D. Creer, "Greater Vancouver Sewage District"; W. G. Chace and James H. Fuertes, "Greater Winnipeg Water District"; J. G. Sullivan, "Rogers Pass Tunnel"; W. H. Sutherland, "Montreal Water and Power Company"; J. H. Larmonth, "Antimony"; J. Fortin, "Mexico Foundations"; H. J. Tippet, "Street Railway Construction"; and Prof. J. B. Porter, "Steam Hoisting in Mines." At the meeting on the 14th inst., Mr. J. A. D. McCurdy, director of the Curtiss Aeroplanes and Motors, Limited, and of the Curtiss School of Aviation, Toronto, read a paper on "Aviation."

Resetting a Derailed Shovel

An old steam-shovel engineer makes the following suggestion: If the front wheels are off of the track, fill the dipper with rock or other heavy material, loosen up one jack arm and swing the dipper over this side. This will raise the other side of the shovel. Put a number of men on the up side jack and tighten it down as hard as possible. Swing dipper over high side and screw down low side jack. Continue this operation until the shovel is off the centre bearing. If there is a key in the king bolt the trucks will be raised off the track. If the rear trucks are derailed, lay blocks in usual manner in order to assist the wheels to climb on the rails. If this is unsuccessful, drop the dipper and boost by means of the thrusting engines.

Cutting iron bridge at Toronto.

Part of the bow of the "Empress of Britain" removed by the cutting blowpipe following a collision in the St. Lawrence River.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Berlin, Ont.
Tenders will be received until noon, October 26th, by John Hessenauer, Chairman of the Sewerage Committee, for the supply and installation of two turbine pumps, capacity 500 gallons per minute, 33 feet head, and for two motors, a.c., with switchboard and instruments. Specifications, etc., at offices of the City Engineer and of the Consulting Enginneers, Chipman & Power, 204 Mail Building, Toronto.

Chatham, Ont.
The City Council have decided to lay a pavement on King Street E. and are considering the construction of a sewer on Forest Street. Engineer, F. P. Adams.

Galt, Ont.
The Town Council are about to lay a quantity of macadam railway and a sewer and storm drain by day labor, under supervision of Engineer C. D. Campbell.

Kingston, Ont.
Work by day labor is about to start on the laying of a macadam roadway on Kensington Avenue and of a number of concrete sidewalks for the City Council. Engineer, R. J. McClelland.

Leamington, Ont.
The Town Council are about to call for tenders on the construction of a concrete pavement on a portion of Victoria Avenue. Clerk, R. M. Selkirk.

London, Ont.
The City Council have authorized the construction of a concrete pavement with curbs and gutter on a portion of William Street. Estimated cost, $3,670. Engineer, H. A. Brazier.

Nanaimo, B.C.
Work is about to start on the laying of a pavement on Machleary Street for the City Council. Engineer, W. A. Owen.

New Westminster, B.C.
The City Council contemplate the grading and macadamizing of Seventh and Belmont Streets and Fifth Avenue. Approximate cost, $7,850. Engineer, J. W. B. Blackman.

Pembroke, Ont.
The Town Council have passed bylaws providing for the construction of a sewer on Alfred Street and for a storm drain on Murray Street. Engineer, W. J. Moore.

St. John, N.B.
Commissioner R. W. Wigmore has recommended the extension of the water and sewage mains on Portland Place. Estimated cost, $4,600.

Toronto, Ont.
The Provincial Highways Engineer, W. A. McLean, Parliament Buildings, has presented a report to the Kingston Road Improvement Committee in which he estimates the cost of the proposed highway between Toronto and Oshawa at $310,000.

The Board of Control will receive tenders until October 26th for the construction of sewers on a number of streets. Plans at office of the Works Department, City Hall.

The Board of Control will receive tenders until October 26th for the laying of sidewalks and asphalt, brick block, concrete and wood block pavements on a number of streets. Plans at office of the Works Department.

Victoria, B.C.
The Council have authorized the construction of sidewalks on Clawthorpe Avenue and Shakespeare Street. Engineer, C. H. Rust.

West Vancouver, B.C.
The Cotton Company, Limited, 1830 Granville Street, are receiving prices on material required in the construction of a waterworks system at Twin Creek for the Municipal Council, including valves, hydrants, galvanized iron and wood stave pipe of various sizes, fittings, pig lead, lumber, etc.

Woodstock, Ont.
The Board of Works have recommended that a glazed tile sewer be laid on Queen Street. Clerk, John Morrison.

CONTRACTS AWARDED

Fort Frances, Ont.
The contract for watermains which has been let to East & Corbin, Fort Frances, has been extended to include a number of additional streets.

Hull, Que.
The City Council have let the contract for the construction of sewers on Montcalm and St. Redempteur Streets to J. Dufresne, 14-16 Champlain Street, at $55,900.

New Toronto, Ont.
The Village Council have let a contract for extensions to the watermains to R. C. Hoffman, care of Dominion Construction Company, 10 Wellington Street E., Toronto. Laterals will be constructed by local labor.

Sandwich West Township, Ont.
The Municipal Council have let the contract for laying concrete and Dolarway pavement to Cadwell Sand & Gravel Company, 84 Sandwich Street W., Windsor, and for concrete sidewalks to the Chick Contracting Company, McDougall Street, Windsor.

St. Thomas, Ont.
The Town Council have let the contract for the construction of a septic tank and sewer bed to A. E. Ponsford, 605 Talbot Street, and for sewers to William Irwin, 59 Curtis Street. Approximate total cost, $8,900.

Toronto, Ont.
The Board of Control have let contracts for the construction of sidewalks to the following firms:—Routly & Sommers, 47 Sparkhill Avenue, Brayley & Nicholson, Hamilton; Godson Contracting Company, Manning Chambers; H. Mitchell, 464 Brock Avenue; Riverdale Concrete Paving Company, 256 Jones Avenue; Standard Concrete Paving Company, 74 Moscow Avenue; A. J. Penberthy, 292 Booth Avenue, and to Works Commissioner R. C. Harris.

The following contracts for the construction of sewers have been let by the Board of Control:—West Toronto Outlet, Jennings & Ross, 79 Spadina Avenue, $8,075; St. Clair Avenue, Fussell & McReynolds, 366 Keele Street, $43,977.

Contracts for paving have been awarded by the Board of Control to the following firms:—Constructing & Paving Company, Confederation Life Building, asphalt on Delaney Crescent and Ward Street, $10,760; Ramsay Contracting Company, 39 Indian Road Crescent, brick block, $2,674; Asphaltic Concrete Company, 74 King Street E., concrete on Dawlish Avenue, $7,551; E. G. Law, 136 Hillsdale Avenue E., rocmac macadam on St. Edmunds Drive, St. Leonards Avenue and St. Leonards Crescent, $13,200; Commissioner of Works R. C. Harris, asphalt on Pine Crescent and Ravensden Avenue, bitulithic on St. Johns Road and Victoria Avenue, $26,214.

Verdun, Que.
The general contract for the construction of about 380 feet of intake pipe has been let by the City Council to Lemoine & Fils, 262 Parc Lafontaine, Montreal, and for the supply of pipe to Farand & Delorme, Limited, 59 St. Martin Street, Montreal.

Railroads, Bridges and Wharves

Calgary, Alta.
Work by day labor is about to start on repairs to the Ogden Bridge. Estimated cost, $14,000. Engineer, G. W. Craig.

Goderich, Ont.
The Grand Trunk Railway Company, Montreal, have been authorized to construct an extension to the siding at the premises of the North American Chemical Company, Maitland Road.

Ingersoll, Ont.
The Grand Trunk Railway Company contemplate the construction of a siding into the premises of the Borden Milk Factory and of the Ingersoll Machine Company. Superintendent, F. Davidson, London.

Moncton, N.B.
The Provincial Department of Public

Works, Fredericton, will receive tenders until noon, November 3rd, for the construction of the superstructure of a steel bridge to be built over the Petitcodiac River. Plans and specifications at office of the Department.

Ontario Province
The Canadian Pacific Railway Company, Montreal, have been authorized to construct an industrial spur for Graves, Bigwood Company at mileage 52.6, Sudbury Sub-division.

Public Buildings, Churches and Schools

Galt, Ont.
Plans have been prepared for a pavilion and band stand to be erected in Jackson Park for the City Council. Clerk, Joseph McCartney.

Halifax, N.S.
Tenders on painting, heating, plumbing and electrical work required at the Evangelical Lutheran Church, Windsor and Almond Streets, will be received until October 24th by the Architect, W. J. Busch, 60 Bedford Row.

Hamilton, Ont.
The Board of Control have recommended the purchase of store and kitchen equipment for the Barton Street Hospital, to the amount of $35,000. Clerk, S. H. Kent.

London, Ont.
The Building Committee of the Board of Education will receive tenders until October 23rd for the supply of school seating estimated to cost $3,500. Chairman, A. E. Silverwood.

Ottawa, Ont.
The Public School Board are considering the erection of an addition at the Elgin Street School. Chairman of the Building Committee, F. Watson.

Port Arthur, Ont.
Tenders on the supply and installation of examining warehouse fittings will be received until 4 p.m., October 29th, by the Secretary, Department of Public Works, Ottawa. Plans, etc., with Thomas Hastings, Postal Station F, Toronto; William Hood, Architect, Port Arthur, and at the Department. Specifications at offices of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

CONTRACTS AWARDED

Glen Robertson, Ont.
The general contract for the erection of a church for the Roman Catholic Congregation has been awarded to J. Element, care of the Architect, F. C. Sullivan, Castle Building, Queen Street, Ottawa. Approximate cost, $23,000. No sub-contracts will be let.

Hamilton, Ont.
A contract for the supply and installation of kitchen equipment at the Barton Street Hospital has been let by the Board of Control to Burrow, Stewart & Milne Company, Limited, Cannon Street, at $3,821.

Louisburg, C.B.
Work has been started on the erection of a school for the Town Council. The general contractor is Angus McAskill, Glace Bay, N.S. A contract for heating and plumbing will be let. Approximate cost, $9,000.

Manitou Rapids, Ont.
The Department of Indian Affairs, Ottawa, have let the contract for the erection of a school to W. J. Russell, 569 Pacific Avenue, Winnipeg, at $4,000.

Sault au Aecollet, Que.
Joseph Lariviere, Sault au Recollet, has started work on laying out the grounds and paving the approaches to the Parish Church. Estimated cost, $7,000.

Scarborough Junction, Ont.
In connection with the addition being erected at the school, the contract for plastering has been let to William Barker, 31 Osborne Avenue, Toronto, the iron work to George Wixon, 77 Swanwick Avenue, Toronto, and painting to F. English, Unionville, Ont.

St. Cyrille de L'Islet, Que.
The contract for painting at the new Parish Church has been let to E. Gervais, 88 Bagot Street, Quebec. Previous report incorrect.

St. John's, Nfld.
The contract for painting at the new Methodist Church has been let to George Noftal, 44 Livingston Street, and for glazing to A. Ramsay & Son Company, 10 Inspector Street, Montreal.

St. Julienne, Que.
The contract for repairs to the Parish Church and Presbytery has been let to P. Brouillet, 2879 Christopher Columbus Street, Montreal.

Winnipeg, Man.
In connection with the First Church of Christ (Scientist), which has been erected on River Street, the contract for metal work and roofing has been awarded to G. A. Broadman, 307 Burnell Street.

Business Buildings and Industrial Plants

Belleville, Ont.
Tenders on the construction of a freight shed, baggage room and waiting room on the Government Wharf will be received until 4 p.m., November 12th, by R. C. Desrochers, Secretary to the Department of Public Works, Ottawa. Plans and specifications at offices of the District Engineer, Confederation Life Building, Toronto, with the Postmaster, Belleville, and at the Department.

Edmonton, Alta.
A company is now being organized for the erection of a curling rink in the Garneau Sub-division. Approximate cost, $3,500. Particulars from R. Ramsay, 11128 86th Avenue, or George W. Robertson, 11032 88th Avenue.

Fredericton, N.B.
R Chestnut & Sons, Queen Street, have been granted permission to build a storage house for dynamite outside the City Building Limits.

Glace Bay, N.S.
F. W. Spencer, 200 Charlotte Street, Sydney, is preparing new plans for a store and residence to be erected for I. N. Chernin. Frame construction.

Hamilton, Ont.
W. Ellis, 76 Myrtle Avenue, has let the general and caryentry contracts for the erection of a garage to T. B. Nicholson, 61 Proctor Boulevard. Hollow tile and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Kenora, Ont.
Plans are being prepared for a lodge hall and store to be erected at First Street and Chipman Avenue for Harmony L.O.L., No. 1689. Architect, F. A. Hudson. Brick veneer construction. Approximate cost, $5,000.

London, Ont.
Building Inspector A. M. Piper is preparing plans for remodelling the interior of the old Ford Offices. Estimated cost, $3,000. City Clerk, S. Baker.

Parry Sound, Ont.
Gentles Bros., Belvidere Hill, have commenced the erection of a skating rink by day labor. Mill and frame construction, concrete and cedar foundation, corrugated iron roofing. Approximate cost, $8,000.

Port Moody, B.C.
The ratepayers have carried a by-law to guarantee the debentures of the Port Moody Steel Works, Limited, to the extent of $100,000. The construction of the Company's plant and rolling mills will be commenced at once. Town Clerk, George Bolt.

W. C. Dempsey and J. R. Bone have secured a site for their proposed evaporating plant, and work will probably start shortly.

Quebec, Que.
Work by day labor has been started on the erection of a warehouse for the Public Service Corporation, 51-53 Crown Street. Brick construction, concrete foundation, metal roofing. Estimated cost, $3,000.

Work by day labor has been started on the erection of automobile showrooms for the Julien Company, Limited, 1232 St. Valier Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

Rimouski, Que.
Work is about to start on the erection of a shingle mill for Price Bros. & Company, 56 St. Peter Street, Quebec. Estimated cost, $15,000.

South Vancouver, B.C.
The City Council are considering the erection of a fire hall on Kingsway. Clerk, J. B. Springford.

Sherbrooke, Que.
Work is about to start on the construction of a gas plant for the City Council. The buildings will be erected by day labor under supervision of J. H. Gordon. Approximate cost, $70,000.

St. Vincent Township, Ont.
William Geddes, Concession 11, St. Vincent Township, is considering the erection of fireproof farm buildings to replace those recently destroyed by fire.

Stoney Point, Ont.
Philip Lavasseur, Third Concession, Comber, Ont., is considering the erection of fireproof farm buildings. Approximate cost, $3,000.

Toronto, Ont.
Work by day labor has been started on the erection of two stores and a storage building for Frank Williams, 1913 Queen Street E. Smaller trades may

be let. Architect, C. Knapton, 63 Woodbine Avenue. Steel and brick construction, concrete foundation, tar and gravel roofing. Estimated cost, $5,000.

Verdun, Que.

O. Peterson, 70 Woodland Avenue, has commenced the erection of a store and flats, estimated to cost $3,500. Brick construction, felt and gravel roofing.

Work has been started by J. St. Onge, 323 LaSalle Avenue, on the erection of a store and residence at Church Street and LaSalle Avenue. Brick encased construction, felt and gravel roofing. Approximate cost, $3,000.

Welland, Ont.

A by-law providing for the establishment of a Municipal bakery will be submitted to the ratepayers on November 3rd. Town Clerk, C. M. Webber.

CONTRACTS AWARDED

Brownsville, Ont.

The general contract for the erection of a barn for Colin Hawkins has been awarded to the Pedlar People, Limited, Simcoe Street S., Oshawa. Approximate cost, $5,000.

Esquimalt, B.C.

The contract for the construction of an oil storage plant for the Imperial Oil Company, Limited, 404 Abbott St., Vancouver, has been let to the Taylor Engineering Company, Credit Foncier Building, Vancouver. Approximate cost, $40,000.

Halifax, N.S.

The contract for electrical work at the store and flats erected on Cornwallis Street for C. Tyman, Creighton Street, has been awarded to Farquhar Bros., Barrington Street.

Hamilton, Ont.

The general, masonry and carpentry contracts for the erection of a warehouse for M. Lax, 94 Cannon Street W., have been let to F. Hiddleman, 93 Florence Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $6,000.

In connection with the addition now being erected at the premises of Arcade Limited, James Street N., the contract for steel work has been let to the Hamilton Bridge Works, Bay Street N., and the painting to the general contractor, R. A. Campbell, 117 Duke Street. Other contracts not yet awarded.

London, Ont.

The sub-contract for steelwork at the repair shops now being built for the London & Port Stanley Railway has been let to McGregor & McIntyre, Limited, 1139 Shaw Street, Toronto, at $10,000. Contract for roofing will be sublet by the general contractors, John Hayman & Sons, 432 Wellington Street.

Montreal, Que.

The Nicholson Constructions, Limited, 960 St. Catherine Street West, are building machine shops on St. Patrick Street for the Canadian Tube & Iron Company, 31 d'Aragon Street, and the Colonial Wire Manufacturing Company, 31 d'Aragon Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate total cost, $13,000.

The contract for the supply of steel for the factory now being built for the Star Boiler & Radiator Company, Limited, 1353 St. Lawrence Boulevard, has been let to Masson Limited, 16 Ramsay Street, Quebec.

In connection with the stores and flats in course of erection on St. Antoine St. for W. Skead, 728 Bloomfield Avenue, Outremont, the general, masonry and carpentry contracts have been let to the Kensington Building & Construction Company, 298 Madison Avenue. Heating and plumbing will be done by owner and contracts let for plastering, painting and electrical work.

Ottawa, Ont.

The general contract for the erection of a garage for T. D. McFarlane, Bank Street, has been let to H. P. Beck, 126 Sparks Street, and the heating and plumbing contract to J. T. Blyth, Frank Street. Brick construction, concrete foundation, felt and gravel roofing.

Point Grey, B.C.

The contract for roofing the garage and stable built for B. T. Rogers, 1531 Davie Street, has been awarded to W. N. O'Neill Company, Limited, 550 Seymour Street, Vancouver.

Quebec, Que.

Work has been started on the erection of a warehouse on St. Leon Street for the St. Lawrence Vinegar Manufacturing Company, 74 Renaud Avenue. The masonry contract has been let to Joseph Chevalier, 44 Renaud Avenue, and the carpentry to A. Dugal, 184 King Street. Brick construction, metal roofing. Approximate cost, $3,000.

In connection with the greenhouse built on Dauphine Street for the Department of Public Works, Quebec, the contract for heating, plumbing and roofing has been let to Jobin & Paquet, Abraham Hill.

St. Laurent, Que.

H. E. Trudeau, 34 Decelles Street, has commenced the erection of two stores, estimated to cost $4,000. The contract for concrete work has been let to Lamoureux & Quesnel, 318 St. Laurent Avenue. Brick construction, concrete foundation, felt and gravel roofing.

St. John, N.B.

In connection with the remodelling of the Provincial Bank, Charlotte Street, the general and plastering contracts have been let to B. Mooney & Son, 112 Queen Street, the carpentry contract to Edward Bates, Duke Street, the painting to James Pullen, Horsefield Street, heating and plumbing to J. H. Doody, Jr., Canterbury Street, and the tile work to Nonneman Tiling Company, 254 Union Street.

Timmins, Ont.

The contract for heating and plumbing at the business block built for F. W. Reed, Timmins, has been let to A. Brageau, Timmins, and for roofing and concrete work to Harry Pudden, Haileybury. Remainder of work by day labor.

Toronto, Ont.

In connection with alterations to the premises at 75-77 Queen Street W., for Major Boyce Thompson, 143 Crescent Road, the contract for masonry has been let to J. Redwood & Son, 9 Howard Park Avenue.

A. J. Gibson, 1228 St. Clair Avenue, has let the general contract for the erection of a garage to J. Craig, 906 St. Clair Avenue W. Brick construction, felt and gravel roofing. Approximate cost, $3,000.

Walkerville, Ont.

The contract for heating and plumbing at the lodge hall and store which has been erected for the I.O.O.F. and E. H. Gregory, 127½ Windermere Road, has been let to J. H. Noble, 277 Dougal Avenue, Windsor.

The Northern Crane Works, Limited, Walkerville, have been awarded a contract for the supply and installation of one five-ton electric travelling Northern crane at the works of the Dominion Stamping Company.

West St. John, N.B.

The general contract for the erection of three large wooden sheds on the wharves has been let by the Department of Public Works, Ottawa, to the Rhodes Curry Company, 65 Canterbury Street.

Residences

Chatham, Ont.

Tenders will be called shortly for the erection of a residence for E. Comhill, Thames Street. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000. Architect, S. G. Kinsey, Fifth Street.

S. G. Kinsey, Fifth Street, is preparing plans for a residence to be built for Louis Palmer, Paterson Avenue. Approximate cost, $3,500.

London, Ont.

J. C. Fletcher, Connaught Street, has commenced the erection of two residences, estimated to cost $3,000. Frame construction, concrete foundation, shingle roofing.

Montreal, Que.

Work on the erection of two flats on Old Orchard Street has been started by J. P. Tremblay, 291 Prud'homme Street. Brick construction, felt and gravel roofing. Estimated cost, $5,000.

A. Duranceau, 486 Hamilton Street, has commenced the erection of four flats, estimated to cost $7,000. Brick construction, concrete foundation, felt and gravel roofing.

The erection of six flats on Chambly Street has been commenced by J. E. Tremblay, 17 Chambly Street. Approximate cost, $6,000.

D. Monette, 1987a St. James Street, has commenced the erection of three flats at Montcalm and De Mortigney Streets, estimated to cost $4,500. Brick construction, concrete foundation, felt and gravel roofing.

Ottawa, Ont.

W. J. Spratt, 157 Sunnyside Avenue, has prepared plans for a residence to be erected on Fairbairn Street at an approximate cost of $5,500. Double brick veneer construction, stone foundation, shingle roofing.

F. Fentiman, Ottawa South Planing Mill, is considering the erection of a residence on Cameron Street at an approximate cost of $4,200. Stucco and brick veneer construction, stone foundation, shingle roofing.

Plans have been drawn for a residence to be built on Fairbairn Street for the Oakland Land Company, Limited, 111 Bank Street. Brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $4,500.

Contracts will be let for plastering, painting, heating, plumbing and electrical work in connection with the residence being built on Woodlawn Avenue by H. J. Beck, 126 Sparks Street.

Quebec, Que.

J. E. Giroux, 51 Cote d'Abraham St., has commenced the erection of a brick residence on St. Augustin Street, estimated to cost $5,000. Concrete foundation, felt and gravel roofing.

Work has been started on the erection of a residence on Fifth Street, Limoilou, by Louis Valee, 66 Fifth Street, Limoilou. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

David Chevalier, 143 Ninth Street, is receiving quotations on all material required in the erection of a residence. Work being done by day labor. Approximate cost, $5,000.

In connection with the residence being built on St. Valier Street for N. Alain, Lorette, Que., quotations on all materials required are being received by the general contractor, J. E. Bovin, 31 Sixth Avenue, Limoilou.

Z. Marcoux, 205½ Des Commissaires Street, has commenced the erection of a residence on Sixth Street, Limoliou, estimated to cost $4,000. Frame and brick construction, concrete foundation, felt and gravel roofing.

Stamford Township, Ont.

James Orr, Robinson Street, is considering the erection of two residences, and desires prices, catalogues and other information with regard to hollow tile, pressed brick, asbestos shingle roofing, electric lighting, hot air heating, birch floors, water heater, stucco plastering, leaded glass.

Toronto, Ont.

Work on the erection of a pair of residences at 7-9 Fulton Avenue has been started by A. A. Grant, 837 Logan Avenue. Smaller trades will be let. Brick construction, shingle, felt and gravel roofing. Estimated cost, $5,500.

Work has been started by R. G. Hammill, 140 Victoria Street, on the erection of a pair of residences at 129 McRoberts Street. Smaller trades will be sub-let. Brick construction, shingle roofing. Approximate cost, $3,200.

A. Edwards & Spiers, 1028 St. Clair Avenue W., have commenced the erection of a brick residence at 173 Lauder Avenue, estimated to cost $4,000. Smaller trades will be let.

Work has been started by J. R. Gifford, 195 Browning Avenue, on the erection of a pair of residences on Gillard Avenue. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $3,500.

Bulk or separate tenders on the erection of a pair of residences at Glencairn and Heather Streets are being received by W. H. Hunter, 50 Chicora Avenue. Brick construction.

Ville St. Pierre, Que.

Albert Leger, 96 Fourth Avenue, has commenced the erection of a residence. Brick work and wiring will be let.

CONTRACTS AWARDED

Hamilton, Ont.

The following contracts have been let in connection with the apartment house built for B. C. Arnedt, 547 Main Street E.:—plastering, J. Moores, 170 Cumberland Avenue; painting, J. Kermath, 146 Victoria Avenue N.; heating, R. Dow, 15 Bay Street N.; plumbing, J. Gibson, 676 King Street E.; electrical work, Snyder Bros., 37 King Street W.

Lachine, Que.

Work has been started on repairs to a boarding house on St. Joseph Street for the Dominion Bridge Company. The general contract has been let to Thomas D. Lonergan, 158 Brewster Avenue. Estimated cost, $3,000.

London, Ont.

The general contract for the erection of a residence for Neil R. Gray, Collegiate Institute, has been let to Harry Hayman, 491 Ontario Street. Red pressed brick construction, stone and concrete foundation, slate roofing. Approximate cost, $5,500.

Montreal, Que.

The following contracts have been let in connection with the flats being erected on Minto and Addington Streets by A. McKay, 498 Argyle Avenue, Westmount:—marble and tile work. Calkins-Leete Limited, 1013 St. Catherine Street W.; roofing, S. Martineau, 1773 St. Dominique Street; plastering, Laniel & Poirier; electrical work, L. B. Smith, 37 Masson Street; architectural iron work, Canadian Architectural Iron Works, Bellechasse Street.

A. Lemay, 147 Cherrier Street, has commenced the erection of a residence at 80 St. Gabriel Street for Charles Bouthillier, Ste. Therese de Blainville. Estimated cost, $5,000.

A. Brien, 116a Eadie Street, is building a residence for A. Toupin, 35 Brissette Street. Approximate cost, $4,000.

Ottawa, Ont.

The contract for heating and plumbing in connection with alterations to the residence of H. R. Welch, 122 Second Avenue, has been let to L. Gendron, 101 Bridge Street, Hull, Que. ... .

In connection with the residence being erected on Sunnyside Avenue by B. A. Grison, 115 Fentiman Avenue, the heating and plumbing contract has been let to J. P. Bland, 755 Bank Street, and the electrical work to H. L. Allan, 377 Somerset Street.

The general contract for the erection of a residence on Powell Street for L. L. Cooke, 359 Somerset Street, has been let to Lewis Bangs, 18 Glen Avenue. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $6,500.

Joseph MacDonald has let the general contract for the erection of a residence on Sunnyside Avenue, to J. M. Hutt, 648½ O'Connor Street. Stucco and brick veneer construction. Estimated cost, $4,500.

The contract for heating and plumbing at the residence built for Mrs. M. Dunning, 295 Creighton Street, has been awarded to A. March, 12 Norfolk Ave.

In connection with the residence being built on Marlboro Street for Barrett Bros., 260 Catherine Street, the contract for heating and plumbing has been let to J. T. Blythe, Frank Street. Electrical work not yet awarded.

Outremont, Que.

The general contract for the erection of a residence for C. A. Roy, 7 Place d'Armes Square, has been awarded to Louis Beaudry, 2420 Hutchison Street, Montreal. Estimated cost, $8,000.

Peterborough, Ont.

The contract for plastering and interior finish at the residence in course of erection for A. W. Cressman, 212 Brock Street, has been awarded to Ephgrave & Barrett, 615 Union Street.

Quebec, Que.

The masonry and plastering contracts in connection with the residence being built for J. A. Choquette, 106 Grande Allee, have been let to A. Poulin, 156 Latourelle Street, and the carpentry to the general contractor, J. Savard, 218 Richelieu Street.

In connection with the residence being built by W. Vaillancourt, 116 Canardiere Road, the carpentry contract has been awarded to E. Bouchard, 185 Crown Street. Sub-contracts will be let for masonry, plastering, roofing, plumbing and electrical work.

In connection with the residence being erected by J. A. Mercier, 44 deVarennes Street, the roofing contract has been awarded to U. Gauvin, 116 Fourth Street, Limoilou, and the painting to Marier & Tremblay, 36-40 Bridge St. Sub-contracts for plumbing, heating and electrical work will be let.

The following contracts have been let in connection with the residence in course of erection on Park Avenue for William Campbell, 86 Maple Avenue:—carpentry and roofing, E. Cantin, 8 Conroy Street; masonry and plastering, A. Fackney, 107 St. Joachim Street; painting, B. Leonard, 53 St. John Street; heating and plumbing, J. Lonergan, 68 Maple Avenue; electrical work, Quebec Electric Company, St. John Street.

A. Bergeron, 253 Prince Edward St., has let the general and masonry contracts for the erection of a residence on Thirteenth Street to M. Tremblay, 67 Second Avenue, Limoilou. Brick and frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $5,000.

Sault au Recollet, Que.

J. Vaughan, Sault au Recollet, has commenced the erection of two residences for J. A. Davis & Company, Limited, 145 St. James Street, Montreal. Brick construction, concrete foundation, corrugated iron roofing. Approximate cost, $6,000.

St. Laurent, Que.

A. Hislop, 217 St. Laurent Avenue, has let the contract for the erection of a residence to J. Robitaille, 117 St. Laurent Avenue. Frame and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

St. Marys, Ont.

The general contract for the erection of a brick residence for John A. McVannel, Wellington Street, has been let to O'Dett & Simpson, St. Marys. Estimated cost, $3,000.

Toronto, Ont.

In connection with the residence erected at 76 Regal Road by J. D. Naylor, 110 Glenholme Avenue, the painting contract has been let to W. A. Putland, 86 Mount View Avenue.

Verdun, Que.

L. W. Julien, Second Avenue, has commenced the erection of three flats for G. Patte, 375 First Avenue. Pressed brick construction, felt and gravel roofing. Approximate cost, $4,000.

Work has been started by U. Proulx, 304 Wilbrod Street, on the erection of four flats for A. Mantha, 225 Church Street. Brick construction, felt and gravel roofing. Estimated cost, $3,500.

Wilfred Gauthier, 261b Fabre Street, Montreal, is building a residence and garage for W. C. A. Gauthier. Rough-cast construction. Approximate cost, $3,000.

Power Plants, Electricity and Telephones

Gravenhurst, Ont.
A by-law has been carried providing for the purchase of power from the Hydro-Electric Commission and for the sale of the power plant at South Falls to the Commission. Town Clerk, W. H. Butterworth.

London, Ont.
The City Council are considering the installation of ornamental lighting on King Street. Clerk, S. Baker.

The George H. Belton Lumber Company, Rectory Street, contemplate the installation of Hydro Electric equipment for operating their woodworking machinery.

Ridgetown, Ont.
The Town Council are considering the installation of an ornamental lighting system on Main Street. Clerk, D. Cochrane.

Welland, Ont.
A by-law will be submitted to the ratepayers on November 3rd providing for the purchase of power from the Hydro-Electric Commission and for the issue of debentures to the amount of $14,000 for machinery and equipment for the Town Electric Station. Clerk, C. M. Webber.

CONTRACTS AWARDED

St. Lambert, Que.
The Town Council have let the contract for the installation of 42 lamp standards and cable to G. M. Gest, Limited, Power Building, Montreal. Estimated cost, $4,250.

Fires

Barrie, Ont.
Fire has totally destroyed a number of buildings on the Burton Farm near this town. Loss, $7,000, partially covered by insurance. Owner, J. S. Browne.

Cadillac, Sask.
The bank building of the Northern Crown Bank, Winnipeg, and the store of F. McGillivray, Main Street, have been destroyed by fire. Total loss, $30,000, partially insured.

Eastview, Ont.
Fire has destroyed two residences belonging to Oliver L. Lanque. Loss, $3,500.

Eureka, N.S.
The plant of the Nova Scotia Underwear Company has been entirely destroyed by fire. Loss unknown.

Guelph, Ont.
The Colonial Knitting Company's mill on Cambridge Street has been destroyed by fire. Loss, $15,000. Manager, Conrad Stub.

Harwood, Ont.
Fire has destroyed a barn owned by W. C. Edmison. Loss unknown.

Lachine, Que.
The Elgise des Saintes Anges Church at St. Joseph Street and Fifteenth Avenue has been entirely destroyed by fire. Loss, $250,000, partially covered by insurance. Priest, Rev. J. T. Savaria.

Loretteville, Que.
Fire has destroyed the residence of Emile Jones. Loss, $5,000, covered by insurance.

Montreal, Que.
The factory belonging to W. P. Downey, St. Peter Street, has been very badly damaged by fire.

Nelson, B.C.
Percy Halliwell's residence has been entirely destroyed by fire. Loss about $2,000.

Peterborough, Ont.
Fire has completely destroyed a barn and sheds owned by R. and L. Shaw, Otonabee. Loss about $2,000, partially covered by insurance.

Port Cockburn, Ont.
The Summit Hotel has been destroyed by fire. Loss, $35,000. Proprietor, A. D. Fraser.

Rossmore, Ont.
Fire has destroyed the bakery owned by F. Thompson and the residence of C. Reddick.

Sault au Recollet, Que.
J. R. Walker & Company's paper mill has been completely destroyed by fire. Loss, $25,000.

Stanstead, Que.
Fire has destroyed the following properties:—Stanstead bakery and barn, owned by G. A. Muir; tenement house, Hartley Gates; residence and store, Thomas Goodsell; residence, George Bayley; livery stable, W. A. Gibson; residence, E. E. Charland; Stanstead Hotel and the Roman Catholic Church. Total loss about $200,000.

St. Hilaire, Que.
Fire has destroyed the barn owned by A. Messier. Loss, approximately $6,000, partially insured.

Ville St. Pierre, Que.
Fire has destroyed eight tenements owned by J. B. Boisvert, care of S. Zachreswonski, St. James Street and Second Avenue. Loss, $8,000.

Wetaskiwin, Alta.
Fire has completely destroyed the lodge hall of the I.O.O.F. The loss is covered by insurance.

Windham Centre, Ont.
The store owned by Oscar Sovereign has been entirely destroyed by fire. Loss unknown.

Miscellaneous

Hamilton, Ont.
Tenders on the wrecking and removal of 28 houses are being received by Toronto Dwellings, Limited, 1 Toronto St., Toronto.

Montreal, Que.
The Canadian Rolling Mills Company, Limited, St. Patrick Street, are receiving tenders on a water tender for water tube boilers.

D. J. Cameron, contractor, desires prices, catalogues and other information with regard to window screens, skylights, ventilators, paroid roofing.

The Canadian Gas Company, 136 St. James Street, Montreal, are receiving tenders on the supply and installation of about 40 miles of 6-inch gas pipe line.

Niagara Falls, Ont.
J. E. Gardner, Morrison Street, is in the market for one 20 h.p. engine and boiler combined for the operation of his sawmill. Gas engines might be considered.

Niagara Falls South, Ont.
F. E. Frantz is considering the purchase of a number of small derricks, operated by team power, for loading heavy piling on cars.

Ottawa, Ont.
Tenders will be received until noon, November 23rd, by G. J. Desbarats, Department of Naval Service, Ottawa, for the supply and delivery at H.M.C. Dockyards, Halifax, N. S., of quantities of steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease, turpentine and chemicals. Information from the Department, and from the Naval Store Officers at Halifax and Esquimalt Dockyards.

Quebec, Que.
E. Julien Company, Limited, 1232 St. Valier Street, are receiving prices, catalogues, etc., with regard to air compressors, electric apparatus, generators and skylights.

Toronto, Ont.
The Board of Control will receive tenders until November 9th for one radial drill for a car barn. Specifications at Room 12, City Hall.

Edward Ramage, 265 Wellington St. W., Toronto, is in the market for one alternating current motor, 20 to 30 h.p.

Revised Standard Specifications for Steel

The British standard and specifications for steel fishplates for bull-head and flat-bottom railway rails contains several important revisions. Among the points dealt with are an alteration in the cold bend test for angle fishplates, which are now required to be bent through an angle of 45 degrees instead of flat on themselves as heretofore, and a slight modification in the tensile strength. In consequence of a ruling in connection with the standard specifications for railway rails the brand rolled or stamped on the fishplates is now to be taken as indicating only that the dimensions of the fishplate are in accordance with the British standard, and Clause 16 has been modified to give effect to this view. The British standard rolled sections have also been revised. Four unequal angles, three bulb angles, and two Z-bars have been added to the lists, all of which are in demand primarily for shipbuilding purposes. It has not been found practicable to delete more than one standard section from the lists, as those sizes which are not now required for shipbuilding are considered essential for bridge and underframe work. Certain reductions have also been made in the minimum web thickness of the bulb angles and channels with a view of producing more economical forms of sections.

Tenders and For Sale Department

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Friday, October 22, 1915**, for the construction of concrete sidewalks on Queen Street and Windsor Avenue in the Township of Scarboro.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender will not necessarily be accepted.

FRANK BARBER,
Engineer.
Toronto, October 14th, 1915. 42

Tenders for Radial Drill

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clock noon on **Tuesday, November 9th, 1915**, for the supply of Radial Drill for Machine Shop, Danforth Avenue Car Barns.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
42 Chairman Board of Control.

Tenders for Boiler

Sealed tenders, addressed to J. F. Smythe, Esq., Chairman Water Commissioners, Windsor, Ont., and marked "Tender," will be received by the undersigned up to 12 noon on **Saturday, October 23rd**, for the building and installing at the Windsor Water Works Pumping Station of one 200 h.p. Steel Scotch Boiler—to carry 160 lbs. pressure according to specifications and blue prints on file at the office of the Water Commissioners, City Hall, Windsor, Ont.

The boiler must be registered for the desired pressure in the Province of Ontario, and proper Government Certificate furnished before final payment is made.

Each tender must be accompanied by a certified cheque payable to the order of the Water Commissioners, Windsor, Ont., equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited, if the person or firm whose tender has been accepted decline to enter into a contract when called upon to do so, or fails to complete the contract.

If the tender be not accepted the cheque will be returned.

The right is reserved to reject any or all tenders; or to accept any tender.

The Water Commissioners,
W. A. Hanrahan, Secretary.
Windsor, Ont., Oct. 7th, 1915. 41-42

Tenders for the Construction of a Bridge

Separate tenders will be received through registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 2nd, 1915**, as follows:—

(a) For the construction of a reinforced concrete bridge.

(b) For the supply and erection of the structural steel work for a combined steel and concrete bridge.

(c) For the concrete masonry work, concrete floor and timber trestle for a combined steel and concrete bridge.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained upon application at Room No. 311, Department of Works, City Hall, on payment of ten dollars ($10.00), this sum to be refunded upon return of plans. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
42 Chairman, Board of Control.

Engineer desires to represent manufacturers, Montreal and district, on commission. Box 378, Contract Record, Montreal.
41-42

Late News Items

Halifax, N.S.
In connection with the residence being built on Oxford Street for J. H. Rice, 189 Brunswick Street, the contract for painting has been let to Martin & Moore, 247 Barrington Street, the heating to Longard Bros., 213 Hollis Street, plumbing to J. MacKenzie, Upper Water St., electrical work to Farquhar Bros., Barrington Street, and interior fittings to J. K. Hunter, 110 Jubilee Road.

Hamilton, Ont.
The contract for plastering at the residence in course of erection for F. A. Dunlop, 991 Barton Street E., has been awarded to Hill Bros., 307 Emerald St. N., and the electrical work to Cully & Breay, King Street W.

Montreal, Que.
The contract for plastering at the residence being built at 25 Fairmount Street E. has been let to Pascal Larocque, 341 Delanaudiere Street. Owners, School Board of Infant Jesus Parish, 62 St. Joseph Boulevard.

The erection of a transformer building at the Low Level Pumping Station is being considered by the City Council. Tenders will probably be called shortly. Architect, A. Chausse, City Hall.

Ojibway, Ont.
The contract for the construction of a drainage system for the Canada Steel Corporation has been awarded to John Dewhirst, care of J. Moynahan, 21 Parent Avenue, Windsor. Approximate cost, $10,000.

Oxford West Township, Ont.
Tenders on the construction of the Mayberry Drain will be received until October 30th by Byron G. Jenvey, R. R. No. 5, Ingersoll. Plans and specifications with Mr. Jenvey.

Wallaceburg, Ont.
The Town Council are receiving tenders on the material required in the construction of four miles of transmission line, including poles, cross arms and No. 6 bare copper wire. Engineer, W. R. Waybourne.

Winnipeg, Man.
Tenders will be received until October 27th by M. Peterson, Secretary of the Board of Control, for 3,000 feet of 2½-inch rubber lined fire hose and 12 non-interfering fire alarm boxes. Specifications at office of the Fire Chief.

Gyrostatic Control Devices

In a paper read before the Institution of Engineers and Shipbuilders in Scotland, Dr. J. G. Gray described a number of new gyrostatic devices for controlling moving bodies, such as torpedoes, and showed that they possessed marked advantages over those at present in use. The latter were effective only for short distances, but the new devices could ensure the maintenance of motion in a straight line for very long distances. Torpedoes thus controlled could also be steered by wires, but the author considered that the direction of torpedoes by wireless transmission was not practical at present, as the sending apparatus would have to be tuned to the receiving apparatus on the torpedo beyond the possibility of interference from without. Aeroplanes and airships capable of being steered and elevated or depressed, under the control of electrical action, could be devised. Dr. Gray held that motor gyrostats would in the future play a great part in warfare, and urged that the country should take the lead in the scientific advancement of the subject.

A French firm is producing cement from the scum formed by boiling beet for sugar manufacture. The scum consists chiefly of carbonate of lime and water. Out of 70,000 tons of beet 4,000 tons of carbonate of lime is obtained; to this 1,100 tons of clay is added, the resulting product being 3,162 tons of excellent cement. The scum is pumped into large tanks, where it is allowed to dry partially; finely divided clay is then mixed with it; the mixture is thoroughly amalgamated with beaters for an hour and burned in a rotary kiln, much in the same way as Portland cement. The clinker is then removed and pulverized into cement.

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Can We Build Radial Brick Chimneys?

IT has come to our attention lately that a number of firms prominent in the erection of large chimneys in this country are German. We think we are safe in saying that practically the whole of this business has been going to three concerns whose operations are controlled either by Germans or by German-Americans. Mention might be made of one firm whose home office is at Chemnitz, Germany. This firm has carried out a great deal of work in Canada, their more recent work including chimneys for the C. P. R. at West Toronto, for Barber & Ellis at Brantford, and Brigdens, Limited, Toronto. They are still bidding for Canadian work.

Aside from the question of violating the principle of trading with the enemies of the Empire, it occurs to us very forcibly that here there is an opening for Canadian industry. The design and construction of these chimneys are perfectly straightforward, and we understand that the radial brick are actually being manufactured in Canada at the present time.

The Contract Record hopes that its readers will look into this matter and furnish any information and suggestions calculated to be helpful in establishing and promoting what should be a branch of the Canadian constructional industry.

Choosing Architects by Competition

ALTHOUGH architectural competitions are frequently used as a means of choosing architects or of securing preliminary designs, it is very doubtful, says the Engineering Record, whether this method is conducive to best results. Engineers are comparatively free from this practice except in the design of some structures such as small bridges. A few years ago when an engineer submitted a plan for a bridge he was very apt to find himself in competition with one or more bridge companies, but now, even in this branch of engineering, it is common practice to employ an engineer who prepares his own designs, which are then submitted to bridge companies for bids. Architectural competitions are generally of no advantage to the owner. To make them successful he must first choose an advisor, whose duty it is to formulate the terms on which the competitors must base their designs and to conduct the competition. The American Institute of Architects has given this matter considerable attention, and under the code of that Society it is unprofessional for any member of the Institute, or, of a Chapter thereof, to participate in a competition, whether as competitor or as junior, unless the programme shall first have been approved by the Committee on Competitions of the Institute or by an authorized sub-committee. A contest of this kind is a slow and expensive process of choosing an architect, and in a great majority of cases it would be much better if he were chosen directly and solely upon his fitness to design and to superintend the work. It is possible that a competition may bring forth a meritorious general design for a building, and the author thereof be so entirely lacking in executive ability and in the technical knowledge necessary to prepare detailed designs as to be incapable of carrying the work to successful completion.

Rather an interesting legal decision of the Washington Supreme Court has it that the authority of an architect is not absolute. He is bound by the general rule of agency. In the absence of an express contract or compelling facts, it is never held as a matter of law that an architect has any power to purchase material or to enter into a contract for or on behalf of the owner. An architect who draws plans for a building and supervises its construction has no authority, express or implied, to make contracts with a sub-contractor binding the owner, unless the owner has conferred on him such authority.

The Canadian Society and the Montreal Commissioners

In response to a request that the Council of the Canadian Society of Civil Engineers should be represented at a meeting of the Board of Commissioners for the city of Montreal, the Secretary, Prof. C. H. McLeod, submitted an unofficial presentation of the Society's views. Following is a copious extract from Prof. McLeod's letter:—

"It has not been practicable to have a meeting of the Council of the Society to consider your communication before the hour of your meeting, but I have informally consulted a number of resident members of the Council and of the Society and find unanimous support of the view that the Society as a body cannot under any circumstances undertake to approve, or to criticize in detail, any public engineering work, and that in this case its full duty has been performed when it has urged that the expenditure of large sums of public money upon the enlargement of the aqueduct and the construction of a 10,000 h.p. hydro-electric plant shall cease until the project as now outlined has been studied and reported upon by a board of qualified independent engineers. It has been conclusively established by statements recently placed in the hands of the Society by all of the engineers, not civic employees, who were named in Mr. Cote's letter of August 2nd to Mr. Jamieson that no one of them has ever studied and reported on the second enlargement of the aqueduct and the construction of a large hydro-electric plant, but that on the contrary all investigations by them have been of earlier projects or of isolated portions of the works now in progress.

"In view of the large expenditures which have been made, and the proposed expenditure of still larger amounts of public money on a work which has received no engineering support aside from that of its originator and his staff, and realizing that the project is viewed with distrust by many local engineers, who have some knowledge of it but have no access to all the data necessary to the forming of a mature and comprehensive judgment regarding it, the Council of the Society has thought it its duty to recommend that independent, competent engineers be engaged to report on the proposed enlarged development."

The Architecture of Greater Britain

(Leading Editorial in The London Builder.)

The war has proved that the Colonies—to use a term already becoming inapplicable—are very different from the old communities of that name spread over Magna Graecia, which were settlements having racial kinship with the parent city without definite political ties—a relation which destroyed Greece as a political and national entity while Greek culture and art permeated the ancient world. A common danger and community of thought and ideals are bringing with them the desire for closer political connection, and the Colonies, which in early days were looked upon as a doubtful asset to Great Britain, are everywhere recognized as constituting its greatest claim to the position of a world power. Since such mistakes as those which led to the Declaration of American Independence are now impossible, and as the world now recognizes that the union of the British peoples is cemented by difficulties instead of being dissolved by them, the Empire of Greater Britain may be said to have been consolidated by the German attack on the liberties of Europe.

Britain's destinies have been made imperial by circumstances and fate, and, though they have been often expressed parochially, fate has impelled us to take a greater role than politicians have dreamed of—a role which it needs imagination, sympathy, and incessant work to fit ourselves for, and which should exclude the narrow view in all walks of life.

The civilization of Rome was great, even judged by the standards of the modern world. The saying "Civis Romanus sum" expressed convictions which were echoed in art by the greatest of architectural works, beneath whose shadows we moderns even now feel ourselves to be pigmies; but that civilization had not a fraction of the organization and wealth which have fallen to us like a gift at the knees of the gods. Yet when the spoils of the Seven Seas became our own, as if by chance, we were still an insular people, with no imagination to show us our ultimate destinies; and this insular and parochial character is marked in most of our architectural efforts for the last few hundred years, and has marred the development of our towns, rendering them ugly and soulless agglomerations of buildings sufficient for the time, but impossible for the future. It has among our individual architects produced men who are skilled to the point of perfection in imitating the products of past ages, so long as they were expressed en petite, but who are somewhat staggered by the size and grandeur of the conceptions of our seventeenth and eighteenth century architects, whose schemes were small when compared with those which were considered reasonable in earlier times by the rules of moderate-sized Italian towns. The largest of our modern schemes have their genesis in the unaided work of the engineer; while many of our best architects devote their attention to the design of moderate-sized work of a domestic character.

Influences Bearing upon Canadian Architecture

The welding together of Greater Britain must be the result of a principle of wise compromise, and this has its bearing on architecture as well as on other branches of human activity. Thus we find Canadian architects have learnt from the United States how to look at problems in a broad manner, and we can learn from them to avoid the craven fear of being great in scale and magnificence of conception, while they can learn from us the truth that tradition has much to teach, and that strongly-marked individuality may be compatible with the refinements found in old work.

Mediaeval influences, born of the necessity for protection and shelter, both from enemies and from the inclemency of the weather in times when heating appliances were almost unknown, the cramping influence of the study of small buildings, all have their effect on the modern work carried out in our midst—an effect which such conceptions as those of the Government Buildings at Pretoria, conceived at a greater distance from centres of tradition, may help us to free ourselves from; while the great cities of Australia and South Africa are more likely to reflect the powerful note of development shown in modern American architecture than our own more halting and tentative treatment. And if our own country is to be rightly considered, not as a small and prosperous island community, but as the integral centre of a great ocean-sundered empire to the aggregate of whose commercial developments no limits can be fixed, a newer, greater, and more imperial scale should mark our future buildings.

The closer ties binding together the English communities beyond the seas must surely result in the close interchange of thought, and the community of interests of architects dwelling at home and in the Dominions, which will cause us to learn from the past without allowing it to influence the future as much as it has during the last century, in which we have copied too much and understood too little.

Centuries ago the initiation of great schemes was the work of individuals who happily possessed greater taste and insight than their fellows; now he who has great ambitions in the arts must learn to appeal to communities who have greater means at their disposal than the art patrons of the past, but less knowledge to direct them.

And in this fact lies one of the difficulties of the future; because, until the public learn to understand the importance of good architecture—which can only be done by improving the general standard—they will not insist on having it, which emphasizes the necessity for good architectural education directed towards a single aim, the means by which the best modern architecture can be produced.

The public will ask for what it learns to value, and the architect's part is to improve the general standard, which should be based on the requirements of a great race and an empire, not on views formed by the study and practice of what may be termed parochial architecture, excellent though that may be in its way. In saying this we do not underrate what we owe to the past, the value of which is evident to every lover of art who knows our towns and villages; but the purposes for which buildings were erected and the needs of the population they had to meet were entirely different from the conditions obtaining to-day, which have more similarity with those of Rome in the era of the Caesars than of mediaeval England, and it is therefore natural that we should fail, as we failed in the period of the Revivals, to express new requirements in the old guise. The work of the past is valued by us now because it was built honestly and wholeheartedly for the present, and if our own work has the real architectural merit that will give it immortality it must be built for the present too.

It may be objected that the immense indebtedness of the country at the conclusion of the war will militate against the possibility of such an architectural development as we have suggested, but we do not think this will be the case.

There may be for some time a tendency to restrict expenditure on building to its more utilitarian forms, but in the first place these must be on a commensurate scale to the future position which Greater Britain must occupy; and, secondly, the expansion of trade and industry will, after a time, more than counterbalance what the country has to find in the form of war taxation. Pessimistic prophecy has always been indulged in by the race—the loss of the American Colonies was to be the prelude of our fall, but marked instead the birth of the Empire as we know it; and so we believe that the pessimists of to-day, drawing dreary pictures of an impoverished and overtaxed country recognizing the financial leadership of Washington, will see in a few years' time, instead, a new era of commercial prosperity and advancement in which an invigorated and united Empire will, we hope, be distinguished by its architecture as well as by its material prosperity, and express architecturally the future destinies of Greater Britain.

Opportunity in Iron and Steel Goods

According to a report from Mr. Claude Dyer, Acting Trade Commissioner at Leeds, Eng., interviews with merchants engaged in the iron and steel trade clearly indicate their desire to obtain, if possible, supplies of iron and steel goods from Canada. The stoppage of imports from European sources brought about by the war and the fact that the production in the United Kingdom is, to a large extent, being diverted to military purposes, has curtailed the supply available for commercial use.

Merchants hesitate to rely on United States firms owing, it is asserted, to the constant difficulties which arise in regard to deliveries when once an order has been placed.

It is further intimated that if Canadian makers of such lines as steel wire rods, steel billets, copper or brass rods are able to land these goods at United Kingdom ports at prices which would compete with other sources, a unique opportunity now awaits them.

Effect of Bombardment and Explosion on Concrete and Brickwork

IN a recent issue of the Scientific American we read: "A feature of the pictures of the Belgian forts bombarded by the German 42-centimetre guns is that the walls and roofs struck by the projectiles are not pierced smoothly by the shots, but completely shattered, even when the explosive force of the shells plays no part. These fortifications consist chiefly of concrete and armoured concrete. According to an article by Professor P. Rohland, the same phenomenon has been observed in experimental practice with targets of reinforced concrete. It was found that the shots did not break holes or fissures, as in steel targets, but caused the whole target to crumble into small fragments.

"Professor Rohland holds that the reason for this singular behaviour of concrete lies in the fact that there is a condition of high tension in sheets, walls, roofs, etc., of concrete, due to the colloidal chemical nature of the cement, whose separate particles are pressed extraordinarily close to each other. When this tension is relieved at any point by a bursting shot the complete crumbling of the entire sheet of concrete is the inevitable result. Hence, he advises a return to the use of brick for fortifications. When a brick wall is struck by a shot the result is merely the tearing of a big hole, since owing to the looseness of the structure only the parts in immediate contact with the spot hit are affected."

On the other hand the Peabody Sales Corporation, of Walkerville, Ont., in a letter quoted by The Architects and Builders' Journal, consider that the comparatively small amount of damage done to their factory by a dynamite explosion, on June 21st, 1915, was due almost entirely to the concrete construction. The charge was placed apparently about a foot or less from the brick retaining wall, halfway between two concrete piers on the outside of the building, and directly under a solid concrete slab, which affords a footpath from the pay-roll department entrance to the street. The explosion blew out about ten to fifteen feet of the brick retaining wall, and destroyed the concrete sidewalk slab under which the charge was placed, but there was not one other particle of concrete so much as chipped in any portion of the building. It is their opinion that had this building been an ordinary constructed brick wall, the entire front would probably have been blown in and a large section of the floor space have collapsed.

We venture the suggestion that it was not the system of construction of the main building which saved it from material damage, but the fact that the brick retaining wall and the concrete side walk, both of which were destroyed, received the full effect of the dynamite charge and broke the force of the explosion before it reached the main building, which consequently only suffered from broken windows due to the concussion.

Notes on Sewage Treatment and Disposal

Specially Contributed by R. O. Wynne-Roberts

THE Department of Public Works, Bureau of Surveys, Philadelphia, recently published a report on the "Collection, Treatment and Disposal of Sewage." This report was prepared by Mr. George S. Webster, Chief Engineer, Mr. George E. Datesman, Principal Assistant Engineer, and Mr. W. L. Stevenson, Assistant Engineer. Mr. Rudolph Hering was associated in this work.

While this report was written with particular reference to Philadelphia conditions, it deals with many interesting matters which are common to all cities.

The Department conducted extensive experiments in 1910, the results of which are incorporated in a comprehensive report published in the following year. In addition, and prior to this, Mr. Webster made an examination of the sewage disposal systems in Europe in 1908, whilst Mr. Datesman made another inspection in 1913.

The experiments and the reports were connected with the whole question of the collection, treatment and disposal of sewage, and, consequently, they afford ample scope for notes. In this connection, however, the writer does not propose to confine the observations to the Philadelphia reports, but will have occasion to refer to reports issued by New York, Baltimore, Columbus, Cincinnati, Chicago, London, Manchester, Leeds, etc.

At first sight it would seem almost unnecessary for experiments to be conducted by so many authorities, as sewage might be considered as water containing small quantities of organic and inorganic wastes. Water delivered to a city must naturally be pure and abundant. The quantity of foecal matter per head of population is approximately the same in various cities, but the quantity and character of trade wastes differ greatly: Chicago has waste from packing houses. Milwaukee from breweries and tanneries, Huddersfield from wool factories, Wolverhampton from galvanized iron process, and so on. There is also the question of the dilution of sewage by a large consumption of water, by ground water leakage, and by the admission of rain-water.

All these points must be taken into consideration by the engineer when designing sewage treatment works, and, while works for small cities may be designed with a reasonable margin of safety to provide for fluctuating conditions, it is desirable to make assurance doubly sure by careful preliminary investigation. In large cities, however, when the expenditure of millions of dollars is involved in the construction of works, and a further heavy annual expenditure must be incurred to operate and maintain such plants, it is essential that every precaution should be adopted to ensure satisfactory results. As stated in the Milwaukee 1915 report, "local conditions so largely influence the character of the treatment necessary for a satisfactory disposal of the sewage, that the method successfully applied by one municipality cannot therefore be indiscriminately employed by other cities." Moreover, North American conditions are different from those in Europe. British methods are seldom applicable, owing to the differences in the climatic conditions, habits and requirements of the people, size and character of the streams, and so on. Consequently, experiments conducted by specialists always afford a fund of new information which is ever welcomed by engineers.

In the matter of collection, it is important to remember that the greater the consumption—or as it is often more correctly expressed, the quantity of water used and mis-used—the greater must be the capacity of the sewers, pumps and treatment works. Philadelphia uses about 178 gallons a head a day. Cincinatti uses 131 gallons a head, but it is stated that only 60 per cent. reaches the sewers, as that portion used for steam purposes, road and lawn sprinkling, leakage, etc., is disposed of in other ways.

Mr. George M. Wisner in his report of 1911 on Chicago Sewage Disposal Works, expressed the following opinion on the question of abnormal use of water:—"The use of water to-day in Chicago is excessive, and should be cut down . . . . . . as the size of intercepting sewers, sewage pumping stations, and plant for the treatment . . . . . is materially affected. Not only are the sizes of the plants and their design affected, but there is an annual cost, which is practically wasted, to cover the pumping of sewage due to this extravagant waste of water. This is a direct drain on the community without any return." The writer has endeavored to draw attention to this fact in his paper on "The Economics of Waste Water in Cities," and would respectfully urge on Canadian engineers to study this very important matter from all viewpoints.

In the Phliadelphia report there is an interesting discussion of the policy of collecting sewage on the separate or combined systems.

In a city not already provided with satisfactory sewers, it is largely a question of the relative costs of the two systems, although the problem even there is not a simple one; but in a city where sewers have been constructed more or less completely, it would entail an enormous expenditure of money to effect any change. The ideal condition, of course, would be to separate the sewage from the storm water so as to reduce, as much as possible, the volume to be treated daily, and allow the storm water to be discharged out to streams, rivers, or lakes. It must, however, be borne in mind that, to effect this, every house must have two drains,—one for sewage and the other for rain-water: the paved yards and the roof would be connected with the latter drain, and gulleys which were intended for wash water, etc., would have to be slightly elevated above the yard surface, and be connected to the other drain. The householders would have to observe carefully the regulations as to the use of two sets of gulleys, but in the experience of municipal officers such regulations would be observed very casually. If this would be the result, the discharges of both drains would need treatment.

Carrying the consideration further, storm waste conduits must necessarily be built of ample capacity, and would be used occasionally, but any discharges of polluted water from the houses would convert the storm water conduits into elongated cesspools, and would tend to cause a nuisance. Apart from this, the first wash of a storm-water discharge would often be as offensive as sewage, and would require treatment as sewage. After the conduits have been scoured, the water might be allowed to be discharged into a stream or river, as, apart from the discharge of storm water, the stream or river would no doubt be changed in quality by a turbulent flood.

If sewage and storm water were allowed to flow in one channel the volume would be increased according to the intensity of the rainfall, the slope and character of the district, and the length of the sewers. Consequently it is probable that the capacity of the sewer would have to be many times that of a sewer in a separate system. The sewage during a rainfall would be greatly diluted, and if conveyed to the treatment works would impose a tax on their capacity. The first wash would necessarily have to be so treated, as slime and sediment would be scoured with it; but after the sewage had been diluted, say, beyond six times the dry-weather flow, the surplus could be discharged by overflows, leaping weirs, or other devices into adjoining water-courses.

Philadelphia has 1,300 miles of combined sewers, and therefore the question of adopting the separate system was out of the range of practical politics. Nevertheless, the authors of the report, in discussing the matter, stated that "the introduction of the separate system undoubtedly would have an advantage over the combined system in the matter of collecting the sewage at a more uniform rate and less in amount, would exclude all sewage, even at times of storm, from the water-courses, and would lessen the load upon treatment works, and prevent possible detriment to their operation due to absence of grit or changing sewage characteristics."

On the other hand, a combined system in that city would mean obviating the expenditure of about twenty-five million dollars for dual connections and the rearrangement of plumbing.

The advantages of a combined system may be stated as follows:—

"As the first flush of rainfall contains the deposits on the sides of the sewers and the filth from the street surface, it is generally more polluting than the ordinary dry-weather flow of sewage. When the combined system of sewers is used, this is intercepted and conveyed to the treatment works.

"The increased fluctuation in flow to the works by the use of the combined system is compensated for by decrease in concentration of the sewage; therefore it would be susceptible of passage through the works at greater speed.

"The occupation of less space in the streets, by the single conduit of the combined system instead of the two of the separate system, and by one set instead of two sets of lateral house connections, with consequent lessening of interference with the sub-surface structures."

The report stated that the concensus of opinion is given against the employment of the separate system in closely built-up urban territory, except in low-lying areas subject to river overflows, or for the protection of a water supply.

The separate system was adopted by Capetown, and by many British towns. It is also in operation in some Canadian cities, but its adoption is a matter for careful consideration, and must be governed by local conditions. Observations made at some works indicate that the reduction of the period of retention of sewage tanks—or, probably more correctly expressed, the increased velocity of flow through such tanks—does not seriously affect the results of sedimentation when the volume of sewage is increased three times. The volume of sewage between three and six times the dry-weather flow should be treated in separate storm-water tanks and filters, and the volume over and above six times dry-weather flow may be allowed to discharge into streams without treatment.

Reference has been made to leaping weirs and overflows. The principle adopted in the design of collecting sewers in Philadelphia is "a radical departure from the design of similar structures heretofore in use in American cities."

"The design of these structures where such collecting sewers have been in operation for a period of years has been worked out in a scientific manner in a number of European cities, and the eminently satisfactory results upon the water-courses have been observed."

In Europe "the conditions for constructing collectors were ideal, as their grades were made to control, and not to be controlled by the grades, and therefore the elevations of the tributory sewers at their confluence."

This statement is rather difficult to understand. If a grade is made to control the capacity of the collector, the dimensions of the collector are manifestly controlled by the grade. The grade may, under suitable conditions, be selected so that the carrying capacity of a sewer is fixed and all excess flows must be diverted. This implies the use of leaping weirs or similar device. On the other hand, if the collector is not controlled by the grade, it may be assumed that excess flows are disposed of by overfall weirs.

As the description of the design of collectors given in the report was not clear to the writer, inquiries were made, and Mr. Webster was good enough to amplify the description. The sewers now discharge directly into the river, but it is necessary to divert the normal flow to the disposal works and allow the surplus due to rainfall to be discharged into the river. Consequently a new collecting sewer will be constructed to intercept the sewage, and this will cross under the existing ones. In the existing sewers "whose flow is to be intercepted a dam will be built, the crest of which will be at the elevation of the maximum flow to be taken into the collector. Upstream from the dam there will be a diverting channel leading the dry-weather flow through an opening in the side of the sewer, in which will be hung by a horizontal shaft an unbalanced butterfly valve. The continuation of this channel and opening leads to the collector, which has been carried under the combined sewer under the dam.

"During dry weather the sewage will flow through the channel, under the valve, and into the collector. When rain-water is added to the flow, and the quantity of flow in the sewer increased, its elevation rises, but up to the height of the dam all can pass through the opening under the valve.

"When the height of the water rises above the elevation of the dam the butterfly valve automatically closes nearly shut, leaving but a small opening between its lower edge and seat—in fact, just enough so that when the combined sewer runs full the opening will pass a quantity of water equal to the dry-weather flow of sewage.

"All remaining storm-water flows over the dam into the water-courses.

"In cases where sewers discharge at tide water, the dam must have an elevation of 10.00 to exclude high tides, and will be located arbitrarily in the sewer at a point where it will be two-thirds of the vertical diameter. In these cases hinged gates will be built in the dam to act as tide-gates. The cross section of the combined sewer will be enlarged at the dam to afford waterway."

It will be observed that the eccentrically poised gate will allow the first flush of storm-water into the collector, but when the sewage is sufficiently diluted it is byepassed into the water-courses. This arrangement is simple and effectual.

In this connection it is interesting to observe from the Cincinnati report what are considered to be the functions of an overflow and a sewer regulator: "The function of a storm-water overflow is to supply a means of removing storm-water in excess of a certain definite flow in the sewer to the nearest water-course. A sewage flow regulator, conversely, is intended to prevent surcharging of an intercepting sewer by partly or wholly closing the inlet connection from the branch trunk sewer. The general object to be attained is the same in both cases—namely, to allow the admission of domestic sewage to the intercepting sewer, and to divert the storm-water to other channels; but an overflow provides an outlet for storm-water from a trunk sewer, while a regulator prevents the admission of storm-water to an interceptor."

The distinction is somewhat subtle, because the object is to divert the excess volume of sewage, and, as in the case of Philadelphia, an overflow is an integral part of a regulator installation. Leaping weirs, however, do not usually need regulators. As the volume and velocity of a flow increases, the trajectory of the stream flattens at the point of discharge, and consequently it will leap over an opening, whereas in the case of a small volume and low velocity the stream will fall into the opening in the invert leading to the collector beneath the sewer. The Philadelphia regulating valve is less liable to disorder than those operated by floats. The subject of overflow, leaping weirs, and regulators is a most interesting and instructive one, and much could be written about it.

There are other points for discussion, but this will suffice for the present.

An interesting chapter in the history of rapid transit in the city of New York has just been closed by the opening of what has been known as the Steinway tunnel, under the East River, that connected Manhattan at Forty-second-street and Long Island. The tunnel bore this name because the late William Steinway, a large property owner, was interested in it. A company was incorporated to build it in 1887, and a contract was let in 1892, but a financial panic stopped it the following year, and the scheme lay dormant until the subway was in hand. A contract was then let for the completion of the work, and it had to be finished by Januaryy 1st, 1907, when the franchise expired. Trouble with the public authorities delayed the work and the franchise ended with the work uncompleted. The scheme was, however, taken over by the city as part of the additional subway scheme and has now been opened.

Blocking of Concrete Bricks Used in Raising Steel Bridge

In raising a heavy steel highway bridge recently to a height of 5 ft. at one end only, blocking of concrete bricks or blocks was used instead of the customary timber blocking. The work is described by H. C. Hardman in The Engineering Record.

As the bridge was raised from above by means of slings fitting over the nuts on the end pins, it was thought inadvisable to use the ordinary blocking which would have to be removed in its entirety in order to place the permanent concrete pedestals under the bridge shoe, thus leaving the bridge suspended in mid-air until the concrete has set sufficiently to receive its load. To obviate this more or less dangerous condition concrete block piers, made of 4 x 8 x 16-in. blocks of 1:2:4 concrete, were carried up directly under the bridge shoe as it was raised. In this way, the shoe was at no time more than a few inches off a firm bearing. The blocks were of such size and shape that a great variety of course arrangements could be made so that perfect bonding could be secured. The raising of the bridge was made in short lifts of 13, 32 and 15 ins., the whole time consumed being ten hours, which was distributed over three days. At the end of each lift the space between the block pier and the pedestal form was filled with a 1:2:4 concrete, level with the top of the pier, and the bridge brought to a bearing on the pier. By this means, no load was placed upon the fresh concrete. The blocks were laid up with approximately a 1-in. bed and joints, the pier showing a slight settlement as the weight of the bridge was applied to the fresh mortar bedding. The faces of the piers were purposely left as rough as possible by raking the joints, so as to secure a good bond with the concrete poured around them. Small piers forming a bearing for the lifting jacks were built along side the larger piers and incorporated in the pedestals in the same manner.

The blocks were made on a wooden bed in sets of twenty, two hundred being made in all to allow for breakage and imperfect blocks. They were allowed to cure for a minimum of two weeks before being used. At the end of each day's run of the mixer on other parts of the work, the block form was filled from the clean-up around the mixer and the last batch run, so that the cost could not be accurately kept. Approximately, however, the blocks cost 10 cents each.

The labor cost of raising the bridge and building the pedestals and piers was $15.34, the total cost being brought up to about $49 by the cost of material and special lifting apparatus.

Vitrified Brick Construction

By W. C. Perkins[†]

MANY failures occur in brick pavements which can be traced to the non-uniformity of the sand cushion or to a cushion not properly compacted. Many engineers take the ground that the only function of the sand cushion is to provide a uniform bearing for the brick wearing surface—the smooth compacted sand taking care of any inequalities of brick or any variation of the foundation. We believe that the thickness of the bed of sand should be as small as possible, never over one inch.

Resiliency of Confined Sand Under Traffic

It is claimed that a grouted brick pavement should have a cushion so as to give it "resiliency" under traffic. We question if sand confined between a concrete foundation and a brick wearing surface has any real elasticity. We grant it may yield, shift or be compacted by traffic weight on the wearing surface of the pavement and that the cement grouted wearing surface will of itself spring back; but the sand will not follow, and we have a small air space between the sand and the grouted brick wearing surface. This can be easily demonstrated by a hammer survey of any cement grouted brick street laid on a sand cushion. The hollow spaces are readily located. These areas may be separated by solid areas where as yet the cushion has not left the pavement. The bond at these hollow spots may be intact and show no distress, but these areas become weak spots in an otherwise good pavement and eventually there may be a settling or a breaking of the cement bond.

It has also been claimed that a sand cushion prevents the crushing of the brick wearing surface under the weight of traffic. Mere weight does not crush a grouted brick pavement laid on a solid foundation, provided it has a firm bearing or bed for the brick. If paving brick manufacturers cannot make a paving brick that will bear the crushing force of street and highway traffic, they had better stop making brick.

Good Results Hard to Obtain

Again, in actual construction, while we may give elaborate directions as to how the sand cushion is to be rolled and struck with a template, we find that to obtain good results in the field is almost impossible, and we have an unstable layer of sand varying in compactness and thickness between a solid foundation and a solid wearing surface. There is also the hazard of the sand working up between the joints of the bricks and thus weakening the bond when the pavement is grouted. A rolled wet sand cushion, if it dries out after the bricks have been laid, will undoubtedly shrink and then leave hollow spots under the wearing surface.

Try Sand and Cement Cushion

In view of all the hazards of using sand for the bedding course, engineers are beginning to turn to the use of a mixture of cement and sand. Mr. Compton, Chairman and Consulting Engineer of the Baltimore Paving Commission, last year made laboratory tests of a cushion mixed 1 to 3, 1 to 5, 1 to 8 and 1 to 10, cement and sand, and adopted for all brick paving work this year in Baltimore a cement sand bed mixed 1 cement to 5 sand. The sand and cement are thoroughly mixed dry and then handled the same as an ordinary sand cushion. The bricks are then laid, rolled and inspected, and the pavement wet down for grouting. This adds moisture to the cement-sand bed and eventually the cement-sand bed becomes hard and practically joints the brick wearing surface to the foundation. The rolling of the brick wearing surface is kept up even with the paver. This is an advantage, for if with a cement-sand bed the paving is rolled and not grouted and we have rain, no harm is done, in fact the rain will set up the cement-sand bed. On the other hand, there is always a hazard when it rains on brick laid on sand cushion and not grouted, as the sand is apt to come up in the joints from the wash, necessitating the relaying of sections of the paving. In Baltimore, Lexington Street, the area from Calvert Street to Liberty Street, was paved with brick in 1906, on a 4-in. concrete base, using a ½-in. mortar cushion, mixed 1 to 3. Mr. Compton states that this street stood up splendidly and that no complaint has ever been made as to noise. During the last three years the street has been all "shot" to pieces by sewers, gas, water, steam heating lines, etc., so that at present it is in bad shape from "cuts," but there were absolutely no failures caused by the original construction.

Another example of the durability of a grouted brick pavement laid on a cement-sand bed is furnished by the paved approaches to the Pennsylvania Railroad Terminal in New York City. These approaches were paved in 1910, the bricks being laid on a cement-sand bed mixed 1 to 3. The pavement to-day shows no signs of deterioration except along the crubs where the wheels of heavily loaded wagons skidding down the inclines have cut into the bricks.

Theoretical Type

The theoretical type of construction is that developed by W. T. Blackburn, of Paris, Ill., who, assisted by Mr. Parrish, a local contractor, is laying the brick wearing surface direct on the freshly laid concrete foundation.

The advantages claimed in using the cement-sand bed or the new type of construction as developed by Mr. Blackburn are: elimination of the hazard of the sand cushion, as the pavement will not be injured at any time by rain, the wearing surface, with the exception of the filler, being completed each day. If a rainstorm intervenes no damage is done, as there is no sand cushion to become saturated and cause worry about rolling the brick surface. Each brick in the wearing surface will be assured a cement bond its entire depth, for if the cement sand should work up in the joints, it will set up and prevent the shearing action which tends to crush the top of the brick. There is no chance for the bed to shrink or shift away from the bottom of the brick wearing surface, as the brick is firmly bedded in the cement sand or held in the mortar of the concrete base. Where these pavements have been laid there seems to be a total absence of any rumble under traffic. Slight settlements and breaking of bond due to non-uniformity of sand cushion are eliminated.

The export of wood goods from Norway during the first six months of this year amounted to 797,000 cubic metres, against 462,000 cubic metres during January-June, 1914, and 587,000 cubic metres in the same period in 1913. Over 740,000 cubic metres went to Great Britain.

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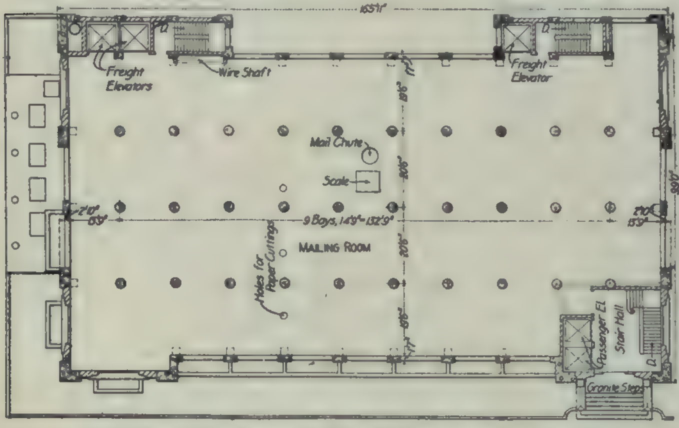
[*] Abstract of paper presented at the Dayton (Ohio) Convention of the American Society of Municipal Improvements.

[†] Chief Engineer, Dunn Wire-Cut-Lug Brick Co.

Large Saving in Steel Effected by New System of Flat-Slab Reinforcement

THE recently completed Youth's Companion Building at Allston, Mass., is a six-storey reinforced-concrete structure which contains a new type of flat-slab reinforcement which is asserted to effect a saving of from 20 to 40 per cent. in the steel required for slab reinforcing as compared with ordinary types. The following general description of this building and the details of reinforcement are given by The Engineering Record.

The building, which will be occupied exclusively by the printing, editorial and business departments of the publishing company, has 165 ft. frontage and is about 100 feet deep. The columns are spaced as shown on the accompanying plan, the typical floor slabs being 14 ft. 9 in. x 20 ft. 6 in. The storey heights vary from 11 ft. 9 in. in the basement to 14 ft. for the first and fifth floors, the other floors having the following heights: second floor, 13 ft.; third floor, 12 ft.; fourth floor, 13 ft., and sixth floor, 12 ft. 8 ins. to the ceiling. A sub-basement extends over about one-third of the building. The exterior finish is concrete with spandrel walls and large steel-sash windows, with a brick and concrete tower at each end, and brick parapets.



General plan of first floor of Youth's Companion Building.

Footings and Columns

The foundations are on fine compact sand and all columns have independent footings. The interior column footings are square, 8½ x 8½ ft., and 3 ft. deep, reinforced with two layers of steel, each consisting of seventeen round ¾-in. rods. The wall column footings are 8 x 6 ft. and 2 ft. deep, reinforced with twenty-seven round ⅝-in. rods in the shorter direction and eighteen round ⅝-in. rods in the longer direction.

The interior columns are round, 26 ins. in diameter in the basement and 22 ins. for the remainder of their length. Ornamental column heads at each floor are 6 ft. in diameter. In order to carry the heavy loads in the lower storeys the columns in the basement, first and second storeys were made of a richer mix, 1:1:2 proportions, with spiral reinforcement. Above these storeys longitudinal reinforcement and 1:2:4 mix were used, with ⅜-in. ties 1 ft. apart.

Three standard thicknesses of floor slab were used: a 9-in. slab for the second floor, which carries the heavy printing presses, designed for a live load of 300 lbs. a square foot; an 8-in. slab for the basement over the sub-basement, and for the first, third and fourth floors, which will be used for storage rooms and the remainder of the printing plant, designed for 200 lbs. a square foot live load; and a 7-in. slab for the fifth and sixth floors and the roof, designed for a live load of 100 lbs. a square foot, with special design under heavy vaults. These upper floors are used by the business department.

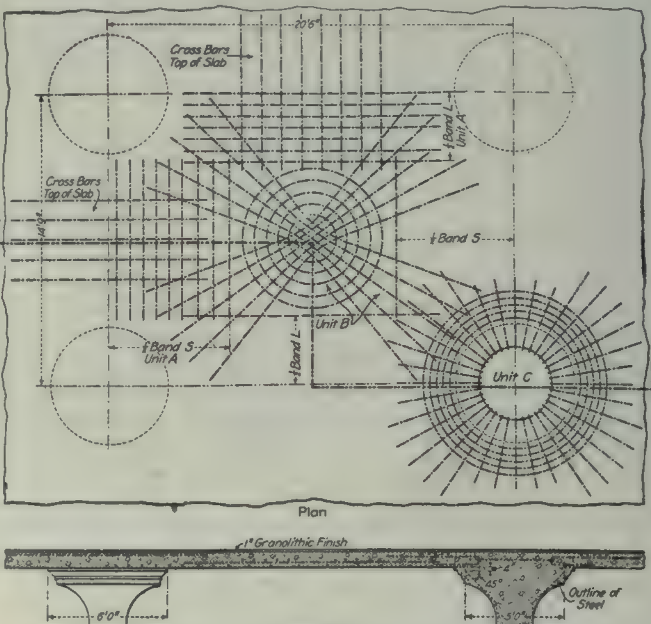
All floors have a 1-in. granolithic finish, cast after the structural slab had set.

Floor-Slab Reinforcement

The floor reinforcement for each type of slab is patented and is known as the Smulski or S-M-I system. It consists of three separate units as indicated on the drawing; unit A, a series of short rods at the bottom of the slab, which form the cross bands; unit B, the bottom steel at the centre of the panel, and unit C, the top steel over the column head. The arrangement of steel in this floor design is patented.

Unit A for interior panels consists of ⅜-in. round rods 8 ft. long for the short sides of the panel and 13 ft. long for the long sides, bound together at the specified spacing by two and by three ⅜-in. tie rods respectively. The number and spacing of the rods in these units is varied according to the loading. For the exterior panels ⅝-in. and ½-in. round rods are used. Unit B consists of five concentric rings, spaced 7 ins. apart, and two sets of five rods each placed in a diagonal direction, and slightly curved as shown. The ends of the rings, which are deformed rods, are looped forty diameters to form the splice. Unit C consists of six concentric rings and from thirty-six to forty radial rods, bent in a U shape with unequal length of prongs, the upper prong being the longer and serving as tension reinforcement, the shorter, lower prong serving as compression reinforcement.

All the radial rods over the column heads (unit C) are looped around a centre ring 3 ft. 8 ins. in diameter,



Sketch plan and section, showing units in typical panel.

which consists of either a 1-in. or a ⅞-in. round rod. The remaining five rings are wired on top of the radials. These rings are lapped and two prongs bent down to reach the bottom of the form to keep the unit at its exact height and position. The single heavy ring serves two purposes: it carries the stress at the column head, and serves to stiffen the unit as a whole during construction and erection. The radials vary in length and size according to their position; those in the diagonal direction take the largest stress and hence are large rods spaced close together, extending farther out from the column head than those parallel to the long side of the panel, which are of the same size, but spaced farther apart; the shortest radials are parallel to the short side of the panel.

The wall units and corner units C are, in general, one-half or one-quarter of the whole column unit C, and are composed of half or quarter rings and the proper number of radials. The centre ring is hooked into the columns and the radial bars are looped about it; the other rings are hooked or anchored into the spandrel beams. These spandrel beams are 15 x 20 ins. and are reinforced to carry the wall loading and to prevent temperature cracks. Roof beams are designed as part of the cornice of the building and each tower has an arched beam at the roof level.

Towers and chutes used in pouring reinforced concrete framework.

Secondary reinforcement of ⅜-in. round rods 8 ft. long over the long cross bands and 10 ft. long over the short cross bands of the A units is placed at the top of the slab to resist negative bending moment over these bands at right angles to them.

Fabricating the Units

Units A and C were fabricated in the yard on templates and stored there until ready for use. Wooden plugs or nails were used to locate the exact position of the rods, and assembly was rapidly accomplished.

The B units at the centre of the panels were easily wired together on the forms. The centre of the panel was marked and the diagonal rods were placed on the forms at their required spacing, after which the concentric rings were placed over them and wired in place.

In placing a floor panel of reinforcement the bottom units A and B were placed first and the upper units C over the columns last.

Advantages Claimed—Theoretical and Practical

Theoretically, it is claimed, this system of slab reinforcement insures the placing of steel in the most effective directions to resist stresses. At the column head the stresses act both radially and circumferentially. The radial rods take the radial stress and the rings, in addition to resisting circumferential stress by hooping action reduce the radial stress and tend to prevent cracks around the head. Another claim is that compression reinforcement at the column head required by the very large compressive stresses is very effectively provided for by the lower prongs of the radial bars placed in the direction of these compressive stresses.

In unit B the diagonal bars converge toward the centre, thus concentrating the maximum amount of steel at the centre of the slab where the stresses are largest. By spreading their ends they reinforce the parts of the slab not covered by the rings and transfer the load directly to the column head.

The centre ring of the C units over the column head is large enough in diameter to avoid interference with column reinforcement and to allow pouring of the concrete into the column shaft. It is pointed out that this centre ring is also of special advantage when a large number of rods is required and where structural steel columns are used. Furthermore, the spacing of the rods in this unit allows room for flow of concrete around all the steel and avoids the massive screen of reinforcement over the column head found in the usual two-way and four-way systems.

Ordinary wood forms were used for the footings, the basement walls and the wall columns. The floor forms were built of 18-gauge metal nailed to 2 x 3-in. joists spaced 4 ins. apart and supported by wooden bents about 7 ft. 6 ins. on centres. Metal forms were used for the columns and ornamental column heads.

Gravel concrete was used throughout for the structural frame and floors. The construction plant was located about 10 ft. below the roadway level in the rear of the large lot. Concrete materials were wheeled in 5-ft. hand carts to the 175-ft. main mixing tower located at the rear and at the centre of the building. Two supplementary towers, one at each end, were connected to the main tower by wire cables. The concrete was distributed by a three-joint metal chute rigged from these cables.

The architects and engineers in charge of the construction are Densmore & LeClear, of Boston. The reinforcing of the floor slabs was designed by Edward Smulski, of the S-M-I Flat Slab System Company, in connection with the office of Sanford E. Thompson, consulting engineer, of Boston. The contractors are the W. F. Kearns Company, of Combridgeport, Mass.

More About the Edison Fire

THE behaviour of the reinforced concrete in the fire of the Edison plant, West Orange, N. J., some little time ago, has been the subject of critical discussion on the part of those interested in advancing the sales of other materials that are used in the structural frames of buildings. When a writer, in one of the periodicals devoted to the lumber interests, seizes the opportunity to say that the buildings, the "latest thing in fireproof construction, as conceived by Thomas A. Edison, himself," and "looked upon by architects as models of fireproof construction," gave no better protection against fire than buildings constructed largely of timber, he shows that he takes a biassed and unfair view of the matter.

Of the concrete buildings it can be said that, where the contents were, in the main, non-combustible, the damage done was slight; one might say they were uninjured. In those where the contents were combustible, but small in quantity, the concrete was somewhat calcined and cracked on the surface and, in some cases, spalled off at the corners. On the other hand, where the buildings were filled with highly combustible materials, such as cabinets, cases, cabinets in course of construction, records and wax for making records, the damage was much greater. In the buildings the interior columns were spalled off at the corners, exposing the reinforcement, and in a few cases they failed altogether. Many exterior columns, or pilasters, failed by diagonal shearing. The spandrel beams over the window and door openings and the edges of the pilasters were spalled off where the flames licked around them.

The floor beams were not damaged badly. Cases of spalling off at the corners and exposing the reinforcement were apparent, but on the whole the damage was slight. Where the floors had settled, due to the failure of the columns, the separating of the slab from the beams indicatd that the workmen had followed the practice of pouring the columns and beams before the slab, thus allowing an initial set to take place in, or laitance to gather on top of, the material already in place in the beams, either of which will prevent the positive bonding of the slab with the beam. At some places there was every evidence of a perfect bond.

It is the opinion of the writer that, had the interior columns been properly hooped, or banded, the damage to them would not have been so great. Also hooping would have kept the vertical rods in the correct position in the columns when the concrete was poured. This applies as well to the exterior columns or pilasters. These latter, however, were subjected to unforeseen bending strains, due to the expansion of the heated concrete, for which they were not designed, and which caused them to fail by shearing.

The vital question for consideration is not whether or not one material is to be used for building purposes to the exclusion of all other materials, but instead what can be done by all, pulling together, to get relief from a terrible tax, placed upon us by fire. Slow burning, mill construction, than which there is no better for certain purposes, has its limitations. These should be recognized and no effort made to extend use beyond them. Exposed steel frame, with steel roof truss construction, with or without brick walls, has its place in the scheme of things, and it should be used in the place where it is best suited. Reinforced concrete has qualities that make it second to none for certain types of buildings, and without steel, our magnificent, multi-storied buildings would not have been possible.

This fire will serve its purpose, and may be considered not a total loss, if it causes us to recognize and appreciate the fact that the inflammable nature of the contents of buildings and proximity to other buildings of a hazardous nature form a risk, the proper safeguarding of which is the first requisite of good engineering.

An ample supply of water at good pressure, and not on the dead end of the system, ample water storage capacity, hydrants well placed and in houses equipped completely, automatic sprinklers throughout the plan, an adequate fire pump operated by reliable sources of power and an underground piping system valved properly should be provided as the yard equipment. Fire walls, with fire doors hung properly, large areas cut into small ones, hazardous operations isolated, plenty of chemical fire extinguishers and metal window frames, with sash fitted with wire glass, on the exposed sides of the buildings at least, should be parts of the building construction. These fire prevention features must be used to insure reasonable protection from fires, regardless of the material employed in the construction of the building.—Safety Engineering.

MR. D. S. Ballantine, writing in the Building Age on the Quantity System, says: "From personal experience I can assure the reader that by its adoption the contractors of this country will greatly benefit themselves and generally raise their standard of business. There is no reason why we should not wish to profit by the experience of others and establish a universal method of estimating on the principle of the Quantity System, as practised successfully in London, revised and adjusted as may be found necessary to meet the requirements of this country. The length of time, the labor involved, and the precise method adopted by the quantity surveyor in the preparation of the bill or schedule, are immaterial to the contractor, and would not concern him any more than the time and labor necessarily employed by the architect in preparing the drawings."

From returns obtained by the American Railway Bridge and Building Association, it appears that of fifty-four leading railways in the United States and Canada only thirteen have not made use of reinforced concrete. The mileage of the forty-one systems on which this material is employed amounts to 138,784 miles, the reinforced concrete structures in use comprising arch bridges, trestle bridges, arch and box culverts, hollow and solid bridge abutments, bridge piers, decking slabs, retaining walls, and city subways.

LETTERS TO THE EDITOR

Quite as Necessary to License Engineers as Doctors

Editor, The Contract Record:

I have been greatly interested in the letters relating to the licensing of engineers, and at some future time I hope to be able to give you my views in detail. I may say, however, that in my opinion the licensing of engineers is quite as important a measure of public safety as the licensing of doctors.

Yours sincerely,
H. N. RUTTAN.*

Winnipeg, October 19, 1915.

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The Licensing of Engineers

Editor, The Contract Record:

In your editorial and Prof. Young's letter on the regulation of the engineering profession, published in your number of September 22nd, you have opened to discussion a question which is perhaps of more importance to the standing of the profession than any other of the numerous considerations which have a bearing on this important subject. It is apparent from the letters you have published that all engineers do not think alike in regard to the closing of the profession. In medicine, law, divinity, and dentistry, it is necessary for a man to have a fair general education, to acquire which requires most of his time through his boyhood and youth to the age of young manhood. This has to be followed by a three or four years' further education along the special lines demanded by the profession he has chosen to follow. In engineering, on the contrary, many members have drifted into the profession from some employment they got while boys who had not yet finished their public school education. Not having any recognized standing that it was necessary for them to attain before calling themselves engineers, they have followed the bent of their own inclination in regard to the amount of preparation they have given themselves for their work. The consequence of this is that there are a great many men practising engineering who are little better than tradesmen. They have no knowledge of the underlying scientific principles of their profession and no education that would enable them to acquire the knowledge. This has a decided tendency to belittle the profession in the regard of the general public. The only way to overcome this is by insisting that every man, before entering upon the study of his profession, must have an education at least equal to that demanded by the other professions, and that he be required to follow a special line of study and reach a certain standard before being admitted to the profession.

It is argued that this would shut out many worthy young men. This is not the case. It would prevent many who have no aptitude for the profession from drifting into it. But in this country of free schools and open opportunities the young man with character, determination, and ability enough to make a successful engineer will have no difficulty in finding a way to the necessary education. We all know men—lots of them—who, without help, have given themselves all the education required. Some have put themselves through college, while others have studied and qualified themselves for the profession while at work.

Undoubtedly it is a mistake to close any one branch—as has been done in Illinois—and not close the entire profession. There may be difficulties in defining the limits or scope of work that would be considered to come under the head of engineering, but these difficulties would ultimately disappear, from the fact that the closing of the profession would make it necessary to establish some fairly definite standard or character of work that would be considered to come within the bounds of the profession.

It is time that everyone who is at present dabbling in engineering would have to be granted a license if he asked for it—without examination, and whether he was qualified to practice or not. It is not clear that either the general public or the profession would be any worse off than they are under present conditions. These same men are practising now, and most of them call themselves engineers.

This condition would begin to improve immediately, but it would perhaps be half a century before the full benefit of restrictive legislation would be acquired.

Yours truly,
A. H. HARKNESS
(of Harkness & Oxley, Consulting Engineers.)

Toronto, Oct. 22, 1915.

Constructional Operations in Winter

"In Some Cases the Winter . . . Has a Distinct Advantage Over the Summer"

Editor, The Contract Record:

The truth of the old saying, "Necessity is the Mother of Invention," is being brought home to us more forcibly day by day. Who would have thought a few years ago that today we should have built and manned a fleet of aeroplanes capable of travelling at the rate of ninety miles an hour, carrying large guns—with their ammunition and crews, and capable, in the course of a few hours, of raiding and destroying enemy positions over a distance which a short while ago would have taken days to traverse? The necessity of war has forced this rapid progress upon us. So, on the other hand, the Canadian winters have forced our engineers to a progress in winter construction which is surprising. A short while ago engineers would have scoffed at the idea of carrying out certain kinds of construction in winter—work which is now an every-day occurrence.

Winter construction has gradually grown upon us: one engineer here, for instance, was forced to complete some work in winter or forego his bonus; another, there, to meet an emergency, had to repair, say, a dam, in winter, and so on, until it was found, on putting experiences together, that many of the difficulties of such winter work had been overcome. Now it is quite common to see much construction in progress during the coldest months of the year. In some cases it has been found that the winter has a distinct advantage over the summer—as for instance, in the placing of foundations in water or wet ground; in fact, so successful has this method proved that in some cases it has been adopted in warmer climates, the ground being frozen artificially.

Light structural concrete work is now carried on throughout the year with success, and at only a small increase of cost, when full and not half measures are taken to protect the work.

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*Mr. H. N. Ruttan needs no introduction to our readers as the former City Engineer of Winnipeg. He now writes us from Fort Osborne Barracks, where he is District Officer in Command of Military District No. 10.

Steel frames are run up with little inconvenience to the erectors: the only precaution it is necessary to take, in this case, is to have all the steel, not encased in concrete, painted in the shops, as paint applied during frosty weather is not satisfactory.

Winter construction is now only a question of cost, and the increase of cost is not always as great as it would appear at first sight. This is particularly the case in large buildings when the necessary protection is afforded, and the heating system is laid out with care and efficiency.

Yours truly,
JOHN HAMMERSLEY-HEENAN.
Montreal, October 19, 1915.

* * *

Enterprise at Montreal

Editor, The Contract Record:

While I do not happen to have photographs of building operations carried out in the winter, I can hardly think of one building which we have put up within the last five years that has not been built to a certain extent during this season. In fact, I do not think that in Montreal the cold weather is given much further consideration as far as the construction of important buildings is concerned.

Yours truly,
G. T. HYDE,
(of Nobbs & Hyde, Architects.)
Montreal, October 20, 1915.

* * *

City Engineer of Peterborough Reports Favorably on the Cost of Winter Work

Editor, The Contract Record:

I do not consider it necessary even in our severe winter climate to shut down all outside construction work. Obviously, there are certain classes of work which could not be carried on safely during extremely cold weather. Mass concrete, however, can be successfully and safely laid in temperatures ranging to twenty degrees below zero, Fahrenheit. In city work, small sewers and water mains in most cases cannot be laid as cheaply during the winter months as during the summer—though this is governed to a great extent by the class of material excavated. In our own city, last winter, it was considered advisable to continue the construction of a new out-fall sewer through the winter months. This sewer was built through sand, the average cut being about fifteen feet, with the ground water level about six feet from the surface. The lower twelve feet was sheet piled with water-tight steel sheeting driven by a pile driver. This material was very treacherous, as we encountered numerous pockets of pure quicksand which boiled underneath the ends of the sheeting and made it very difficult to keep the work going. However, there were only seven or eight days lost by the men on this job during the whole winter.

In comparing the cost of the work done last winter with that done this summer, the conditions being practically the same as regards water and material excavated, I find that there was practically no difference. I might say also that on this work—in order to give employment to the greatest number of men—the gang, with the exception of six or seven specially skilled men, was changed every two weeks. During the summer, conditions improved here so much that this was not necessary. This changing of the gang would naturally increase the cost of the winter work to a certain extent. It is our intention to continue the work on this sewer during the coming winter as continuously as the weather will permit.

I might say that on all of my work up to the middle of last June the gangs were changed every two weeks. A card index of all laborers looking for work is kept in my office, each man's record being kept on his card, so that we can tell by a glance at the card how much work he has done. There does not seem to be any doubt that a great deal more outside construction work can be done in winter than we are doing at the present time.

Yours truly,
R. H. PARSONS,
(City Engineer.)
Peterborough, Oct. 21, 1915.

* * *

Factors Adverse to Winter Work

Editor, The Contract Record:

That concrete can be laid in winter is admitted, but no engineer will undertake winter operations if he can help it. The extra precautions required to ensure perfect mixing, laying, and setting, and the additional expense entailed by the shorter period of daylight, all suggest that engineers should plan their work ahead so as to get the concreting done in the summer time, reserving indoor finish for cold weather.

Yours truly,
W. P. ANDERSON.
Ottawa, October 19, 1915.

* * *

The Problem to be Solved

Editor, The Contract Record:

This subject, which you have discussed so ably in your issue of October 13, is a most important one from many points of view. If labor cannot be employed during all the twelve months of the year, owing to the suspension of operations in winter, workmen must necessarily draw sufficient wages during the working period to enable them to provide for the months of enforced idleness. Consequently, the price of labor must be higher and works more costly. Moreover, idleness, whether enforced or not, is a disadvantage in several ways. Many men are improvident, and have little left at the end of a working season to carry them through the winter, and therefore charity is drawn upon. But apart from improvidence, it is not good for the morale of a community that a section should always be idle at certain times of the year; it engenders a spirit of dissatisfaction and other undesirable conditions of life.

The period of suspension of outside work in Canada varies. In some parts it lasts from November to April. This is a serious drawback to the working classes in particular, but also to contractors and engineers, though perhaps in a lesser degree.

The idleness of workmen also causes the unproductiveness of capital invested in plant, machinery, and organization. Many contractors retain and pay their skilled men during the winter, and often the aggregate amount of wages thus paid is a goodly sum. It follows that the clients must pay the contractors something for the higher rates of workmen's wages, the cost of maintaining idle plant, the interest on unproductive plant, the wages of skilled men who are retained, and for risks which contractors have to shoulder owing to these circumstances. In short, clients have a certain percentage of the cost of building to pay for which does not occur in more moderate climates.

Each country has more or less a character of construction which is suited to its climatic conditions. In the United States, for example, structural steel work in buildings has been developed to a greater extent than in any other country, and reinforced concrete also has probably been used in a larger measure. In Canada, structures are erected very much on American lines. This is to be expected, as in many respects Canadian and American ideas in this regard are very similar. But Canada has not the range of climates that the States possesses. In a large part of the States work can proceed during the whole year, and in the other part the suspension will doubtless be of shorter duration than is the case in Canada. This suggests that in this country it is desirable that buildings should be such as to permit of their erection in all seasons—which means, of course, the evolving of a type which shall be typically Canadian and suited to local conditions.

This subject has engaged the writer's thoughts for some time. It would seem that buildings capable of being erected in winter would consist of a steel skeleton or unit reinforced concrete framing, with light reinforced concrete floors and walls cast in a workshop, and slung into place under cover, and jointed with some mastic which is affected by temperature to a more limited extent than ordinary mortar. This is a matter of design and research, but there do not appear to be any insuperable difficulties, though it will involve some ingenuity on the part of the designer and the application of chemistry to find the mastic.

When such a building was erected heat in some form could be employed to maintain an equable temperature within in order to complete the structure.

Such a structure will remove the dangers of collapse due to defective or frostbitten concrete; and it will employ labor more regularly, as all parts can proceed simultaneously on the building and in the factory. At present, while the steel erectors are busy the bricklayers, masons, concrete men, etc., are kept waiting until the skeleton has proceeded sufficiently, but in the above type of building the floors, walls, and so on, can be cast while the skeleton is being erected.

There are already on the market tubular and other makes of pre-cast flooring, and unit reinforced concrete skeletons are now employed. A short time ago the City Engineer of Liverpool (Eng.) erected a number of houses by casting the slabs, partitions, etc., and hoisting them into place. It would appear, therefore, that the problem will be about solved when the suitable mastic is compounded.

Yours truly,
R. O. WYNNE-ROBERTS.

Toronto, Oct. 18, 1915.

* * *

Planning Work Ahead to Ensure Winter Activity

Editor, The Contract Record:

Your article advocating greater enterprise in promoting constructional work in the winter is a timely one.

Much factory work might be carried out in the winter months if city officials and members of councils throughout Canada gave more systematic attention to future requirements. For instance, contracts covering the requirements of the following year might be given in the fall and winter for water pipes, sewer pipes, engines, and electrical supplies.

This is purely a matter of looking ahead. Most of the trouble is caused by changing the personnel of the councils at the end of the year.

I would suggest that you ask some of the larger firms for their views, and publish them for the benefit of officials who realize the necessity of providing ahead but who are unable to convince members of councils of the wisdom of doing so. This is purely a suggestion, but I am persuaded that the business viewpoint as given by your journal would be more influential than the personal viewpoint of an individual official.

Yours truly,
CHAS. CURTIS,
(President, Western Pavers, Limited.)

Winnipeg, October 13, 1915.

Municipal Management

Editor, The Contract Record:

Some towns have worked the day labor method of carrying out municipal schemes with great success; others have not been so fortunate. Success depends in a great measure on the care and attention to details given in managing such work. Another method is that of a schedule price of payments submitted by the contractor: for instance, the laying of a water main of given diameter at a certain depth is fixed at a definite price, while water mains of a less or greater diameter at a variable depth are all fixed by the schedule of prices. Inspectors are appointed who make out a bill of quantities each day, and the work is paid for on this basis, plus a certain extra percentage allowed.

This is a fairly good method, but it entails a considerable amount of work for the inspectors, bookkeepers and clerks; so that it can be readily assumed that a contractor could perform the work with considerably less red tape. In carrying out any local improvement scheme by day labor, details of the proposed work showing all plans, profiles, and working drawings, together with a suitable specification, should be prepared and definitely lived up to by those engaged in the work; then instead of calling for tenders and giving the work out to contractors it is performed by day labor and the council practically becomes the contractor.

Daily reports are handed in by the outside foremen, giving details of the number of men employed, the rate of pay, the number of teams, and materials used, together with the amount of work completed. From these reports progress charts can be kept, and, as the records are booked up, an accurate account of the expense incurred in carrying out the work is obtained. If this daily amount is totalled up each day the actual cost of the work can be seen at a glance. There can be no argument about excessive extras, and the work can be stopped or suspended before the city is saddled with a heavy debt which the promoters did not intend to incur.

Possibly some of your readers may object to the Council's being turned into a contractor's office, but it behoves every council to be fully informed on the daily cost of municipal management.

Before the work of the proposed scheme is commenced the scheme should be discussed fully by the Mayor and Aldermen in Committee. At such meetings it is possible for the work to be amended as required.

Yours truly,
S. BARLOW BENNETT,
(Municipal Engineer.)

South Vancouver, Oct. 18, 1915.

Mr. Owen McKay, Town Engineer of Walkerville, Ont., writes us regarding the insurance of office tenure, discussed editorially in our issue of October 6. Mr. McKay says that he is in favor of having the subject brought up for discussion at the next annual meeting of the Canadian Society of Civil Engineers.

Lieut.-Col. Hendrie, Vice-President of the Hamilton Bridge Works Company, now on active service, writes The Contract Record from "somewhere in France" acknowledging a copy of our issue of September 28, in which was published a short sketch of his career in the opening article of the "Pro Patria" series.

LETTERS TO THE EDITOR:—The reader is cordially invited to co-operate in promoting the interest of his profession by submitting his views on topics of current interest.

The Use of Concrete in Hydraulic Works, with Special Reference to Its Durability[*]

A large proportion of the enormous annual production of Portland cement is used in hydraulic works. The early use of concrete in American hydraulic works was in masonry walls of the locks of canals and similar work. A number of natural cement plants were established to supply the cement needed in canal construction, the first American cement being produced in connection with the Erie Canal in 1818. Following this first application of concrete it was used in harbour work. In all of these structures concrete was used in mass, and it is only in the last few years that the much more economical and efficient use of reinforced concrete has been attempted for hydraulic works. Over 5,000,000 cubic yards of concrete have been used in the construction of the locks and dams of the Panama Canal. Fig. 1 illustrates the magnitude of all the work along this canal. The handling of such enormous quantities of concrete reached a greater development than has been attained in any other work in this country. The mixers were not very large, but the quantity of the material handled each day was so extraordinarily large that the economical management of the plant was of prime importance. In connection with the Gatun Locks an automatic railway carried the material from the storage bins to the mixers, from which the concrete was discharged into buckets which were conveyed by train to a point where cranes or overhead cables could move the buckets to the point where the concrete was placed.

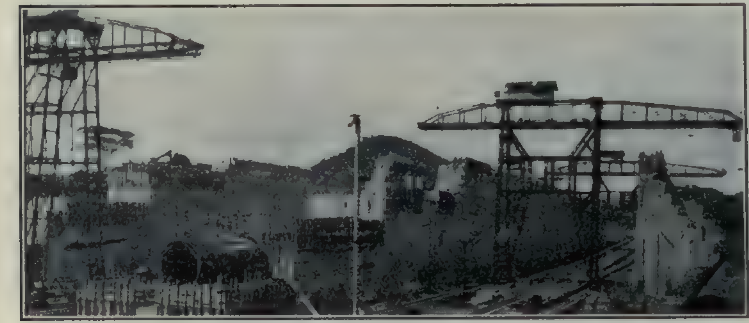

Fig. 1.—Pedro Miguel Locks, looking north from east bank.

Next in importance to the Panama Canal is the New York State Barge Canal, which, although not as long or wide as the Panama Canal, is of much greater extent. The locks are built entirely of concrete, thereby increasing the facility and speed with which they may be constructed and largely decreasing the cost. Perhaps one of the most interesting locks is that shown in Fig. 2. A coffer-dam completely surrounded the locks, the massive walls of which were constructed without interference with the river traffic.

In the operation of canals for navigation or irrigation it is sometimes necessary to erect dams and other controlling works to so regulate the flood waters of the river that the required depth in the canal may be maintained. An example is afforded by the Shoshone Dam, which forms a part of the United States irrigation project in Wyoming. This dam was built in an almost inaccessible canyon, of concrete composed of the crushed which the dam was constructed. It is one of the highest in the world and forms a lake extending for a distance of twelve miles back from its crest.

The Reclamation Service has many interesting works in which the value of concrete cannot be overestimated. In many parts of the territory covered by this Service the inaccessibility and lack of the mater- stone obtained from the red granite walls between ials of construction other than sand, crushed stone or gravel have made concrete the only available material. Fig. 3 is a view of the Granite Reef Dam, Arizona, one of the many controlling dams for impounding the water used for irrigation purposes.

One of the important features of irrigation work is the distribution of the water from the impounding reservoirs through the various main and branch canals to the land to be irrigated. It is essential that little of this water shall be lost in transit, and a study has been made of the losses which result from leakage, evaporation and other causes. It is, therefore, frequently necessary to line the canals with concrete, in order to prevent ground leakage, while in some projects the water is carried in covered conduits to prevent the great loss by evaporation in this arid land. Fig. 4 shows a portion of the concrete-lined power canal near Roosevelt, Arizona. It will be noted that part of this lining outside the cut becomes a retaining wall.

It is frequently necessary to carry the canal over a ravine, in which case concrete is an admirable material for the construction of these viaducts, not only as to economy in the cost of structure but also as to its water-tightness, which is illustrated by the view of Aqueduct 8 on the line of the Illinois and Mississippi Canal (Fig. 5).

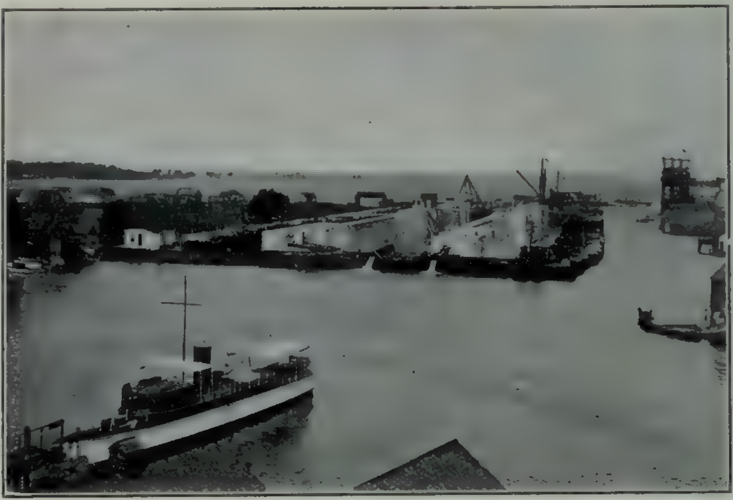

Fig. 2.—Concrete ship lock at Black Rock Harbor, New York.

The Reclamation Service has a number of plants for the manufacture of reinforced concrete pressure pipe in the distribution of water; this pipe can be manufactured and placed for very much less money than cast iron pipe, and there is a saving not only in the cost of manufacture but of the cost of transporta-

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[*] Abstracted for The Contract Record from the Presidential address of Richard L. Humphrey before the American Concrete Institute.

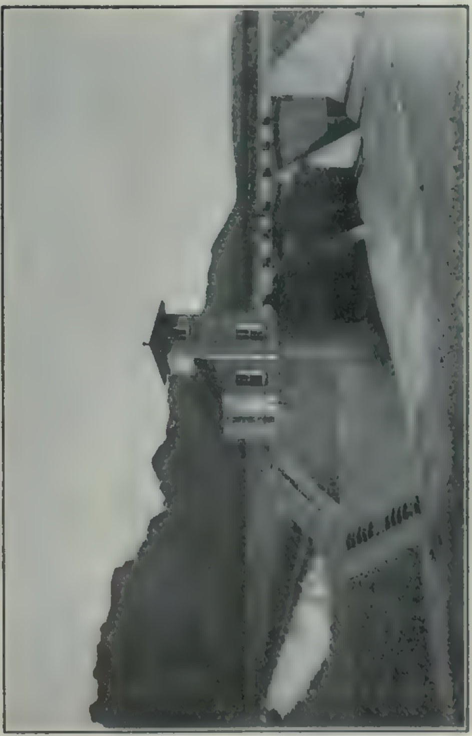

Fig. 3.—Granite Reef dam, Arizona.

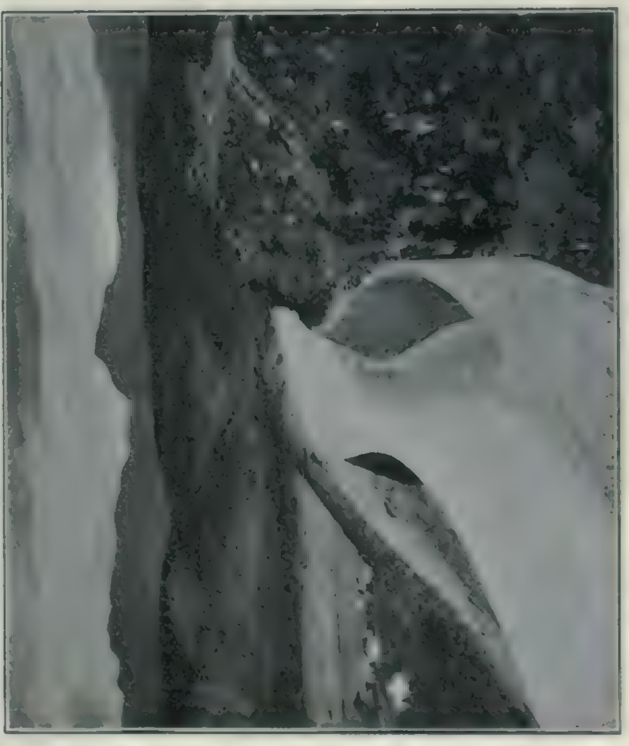

Fig. 4.—A portion of the concrete-lined power canal near Roosevelt, Arizona.

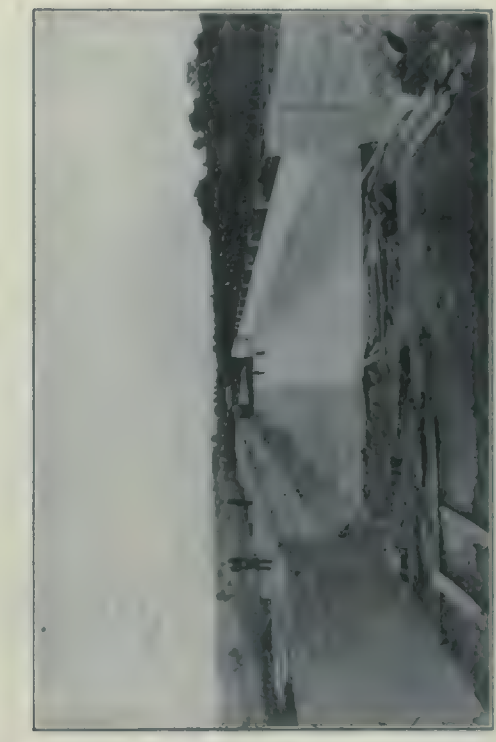

Fig. 5.—Aqueduct No. 8 and Lock No. 27, Illinois and Mississippi Canal.

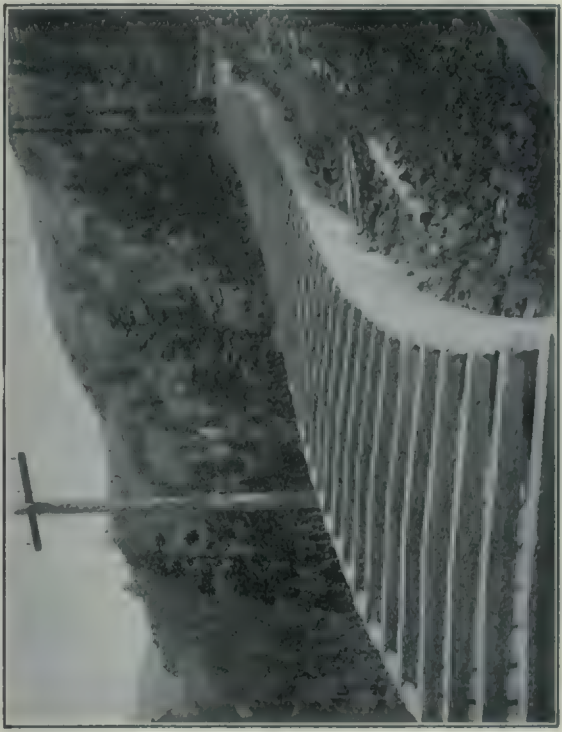

Fig. 6.—Main Tieton Canal, Yakima Project, Washington.

tion of cast iron pipe. Another type of pressure pipe was used in the reinforced concrete conduit 5 ft. 3½ in. in diameter, on Simm's Creek, Sun River Project, Wyoming, which was built continuously in place.

Unusual Construction

A striking example of the adaptability of concrete to unusual forms of construction is illustrated by the view (Fig. 6) of the main Tieton Canal in the Tieton Canyon, Yakima Project, Washington. The rapid fall of the Tieton River is such that it is impossible to place a concrete lining in the canal and it became necessary, therefore, to form small independent sections of the canal. After they had properly hardened they were transported and placed in position as shown.

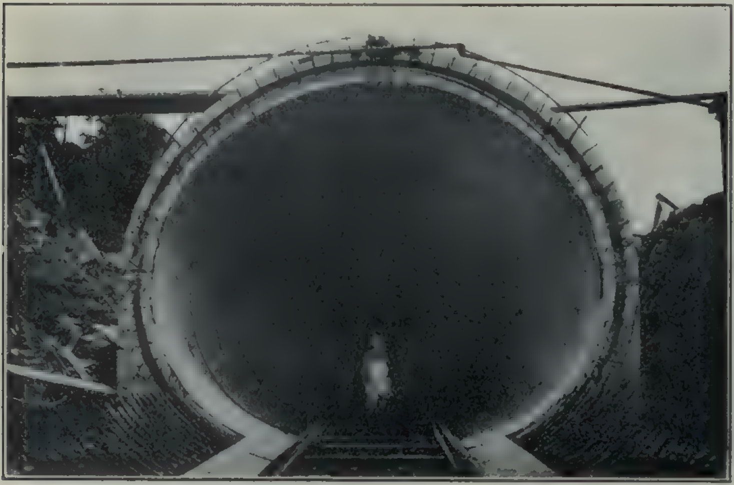

Fig. 7.—Reinforced concrete conduit, Canadian Power Company.

In connection with water power development, concrete again proves itself to be a material of unequalled value. The construction of the main shafts and conduits and other works connected with water power development can all be advantageously constructed with concrete and almost always at a considerable saving in the cost. Fig. 7 is the main conduit of reinforced concrete of The Canadian Niagara Power Company.

The speaker was connected with the initial construction of the bulkhead (Fig. 8) along Delaware Avenue, Philadelphia, in 1897, in which the saving in the cost and the permanency of the structure proved concrete to be one of the most economical materials. This wall was constructed by placing 90-ton blocks of concrete on a mattress filled with mortar resting on the top of piles and casting the walls of concrete in place above the high water line, as shown in the illustration. This wall is over sixteen years old and has proved satisfactory in every way.

Concrete for Breakwaters

Another purpose for which concrete has proved to be indispensable is in the construction of breakwaters, of which there are many types. Some are constructed by placing the concrete in forms; others are composed of large blocks of concrete, moulded on land, and allowed to harden before being so placed as to form a solid mass. In still others, smaller blocks are so placed as to form pockets, which are filled with gravel, stone, or other similar material, the whole extending above high water line and upon which is cast a solid coping of concrete. A type introduced by Colonel Judson of the Corps of Engineers, U. S. A., consists of caissons of reinforced concrete built on land and then launched and floated over their final resting place. There they are sunk by filling them with water, sand, gravel or broken stone. Generally a lean concrete is placed about 4 ft. thick as a base for the coping.

Reinforced concrete caissons prove of great value in the construction of lighthouses where the exposure to wave action is such as to render the erection of any structure difficult. The caissons can be floated to the desired locality and sunk into position. They possess decided advantages as to economy in construction and durability; and their stiffness and substantial character make them practicable for towing for considerable distance regardless of the condition of the sea. In view of the rising cost of timber and its short life under conditions of exposure to sea water, it is evident that this type of construction will be increasingly used in the future. Fig. 10 is a breakwater consisting of moulded blocks forming compartments which have been filled with gravel upon which a solid concrete coping has been placed.

In the protection of shores from the scour either of the sea or of the river, concrete proves invaluable. One of the most notable of such uses of concrete is the Galveston sea wall, erected immediately following the disastrous flood which destroyed the greater part of this city. The toe of the wall is protected by granite blocks and the top raises the level of the city several feet above high tide. It has proved a magnificent barrier against the sea.

Another barrier to prevent erosion of earth embankment is that constructed along the Little Miami Bottoms in the vicinity of Cincinnati, Ohio. A reinforced concrete slab covers and protects a mud embankment for a distance of about one mile. This facing is 5 in. thick and 10 to 15 ft. high.

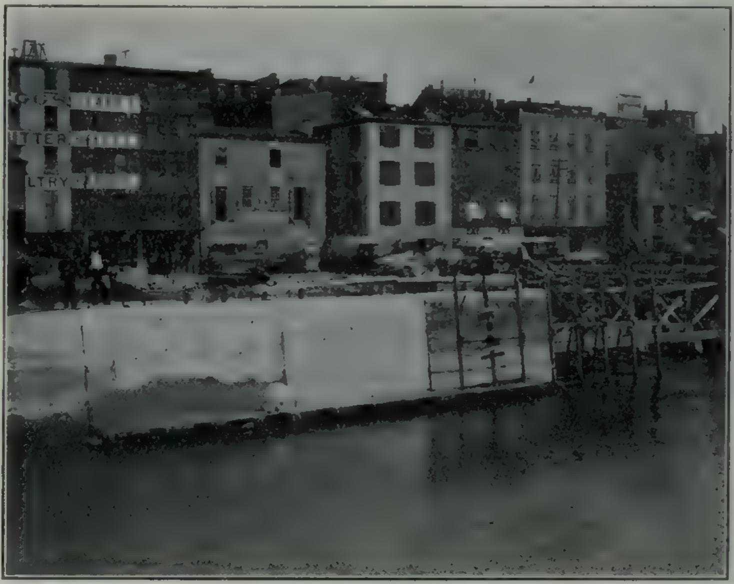

Fig. 8.—Concrete bulkhead along Delaware Avenue, Philadelphia, Pa.

Fig. 11 is an interesting structure devised by Major Shultz, of the Corps of Engineers, U. S. A. It is a reinforced concrete dyke constructed at St. Joseph,

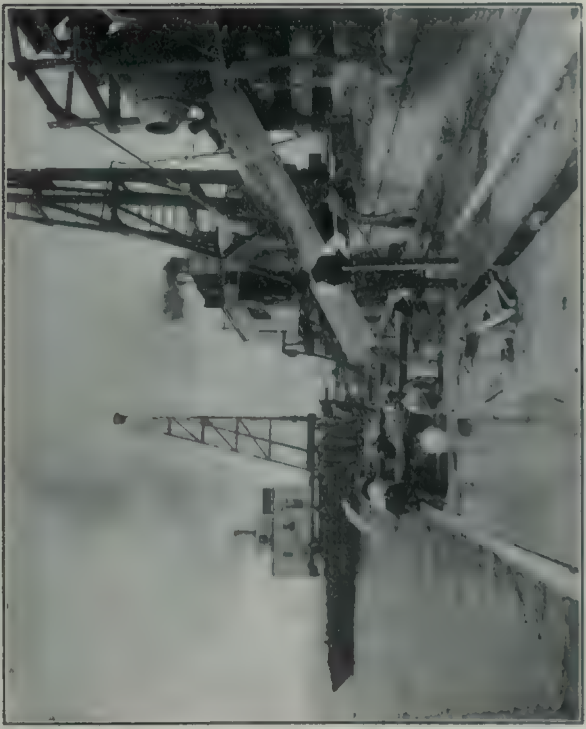

Fig. 9.—Filling reinforced concrete caisson with lean concrete Algoma Harbor, Wisconsin.

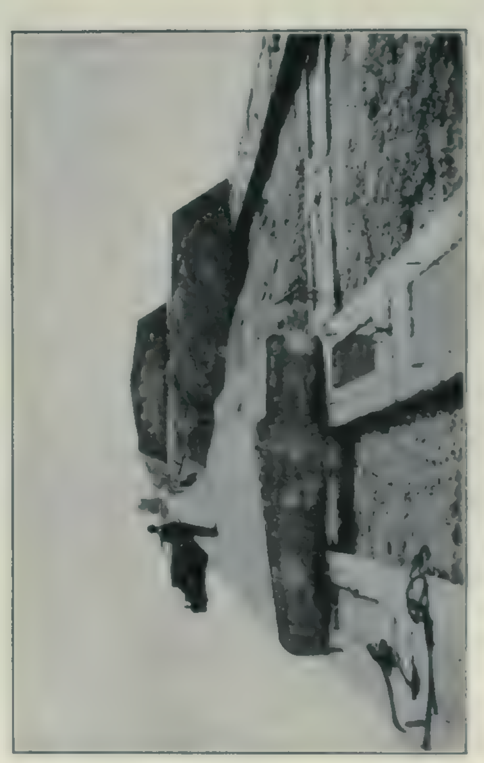

Fig. 10.—Breakwater at Buffalo, N.Y., showing manner of construction.

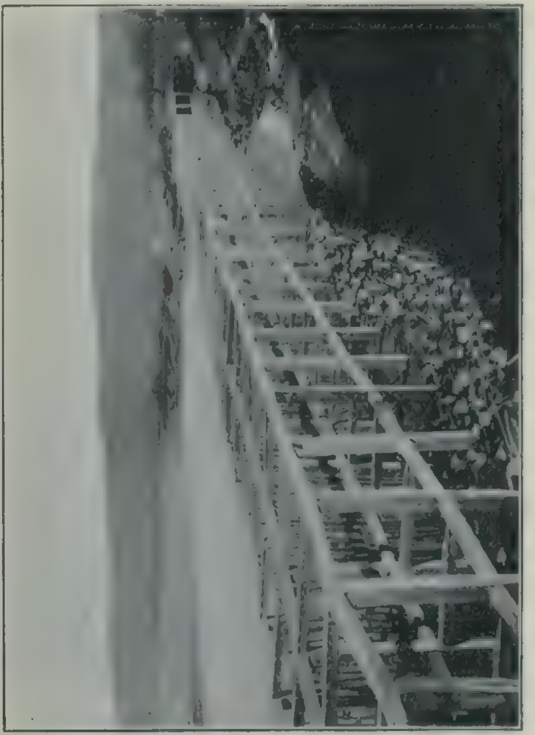

Fig. 11.—Reinforced concrete dyke at St. Joseph, Missouri.

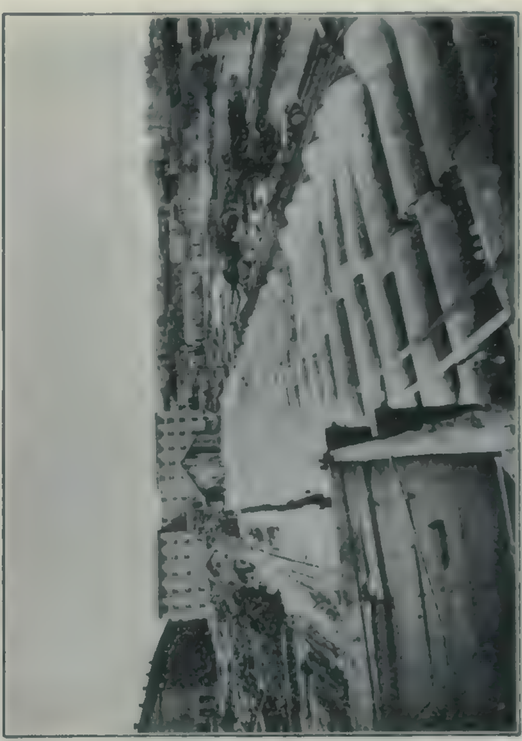

Fig. 12.—Reinforced concret pile shells for pier 8, Navy Yard, Puget Sound, Washington.

Mo. Such structures are usually built of timber, but they lack stability and durability. This has led to their construction of reinforced concrete, as more substantial and durable than timber dykes; further, the cost of repairs is reduced to a minimum and in many cases the first cost is less than that of timber.

American piers and wharves for the most part are built on wooden piles. Because of the short life of the piles this construction has proved expensive in first cost and maintenance. This is particularly true on the Pacific coast, where the life of the piles is extremely short because of the destructive limnoria and teredo. The reinforced concrete pile has, therefore, come into increasing favour as a substitute for wooden piles. In many cases economies can be effected by reason of the fact that fewer piles can be used and the concrete slab placed directly on the tops of the piles at a considerable saving in the cost. The advantages of this pile as to permanence and cost of maintenance cannot be over-estimated. These structures of concrete are generally found to be less costly than timber construction besides showing an additional saving in the decreased cost of maintenance. A great variety of piles are manufactured. Some are moulded on land and when sufficiently hardened are driven or jettied into position; others are formed by driving a metal cylinder or shell where the pile is required, which is then filled with concrete; still others are made by driving a metal cylinder or shell which is withdrawn and the hole left in the ground filled with concrete as the shell is withdrawn. Again, hollow cylinders of reinforced concrete are moulded and when properly hardened are placed in position, the water pumped out and the interior filled with concrete.

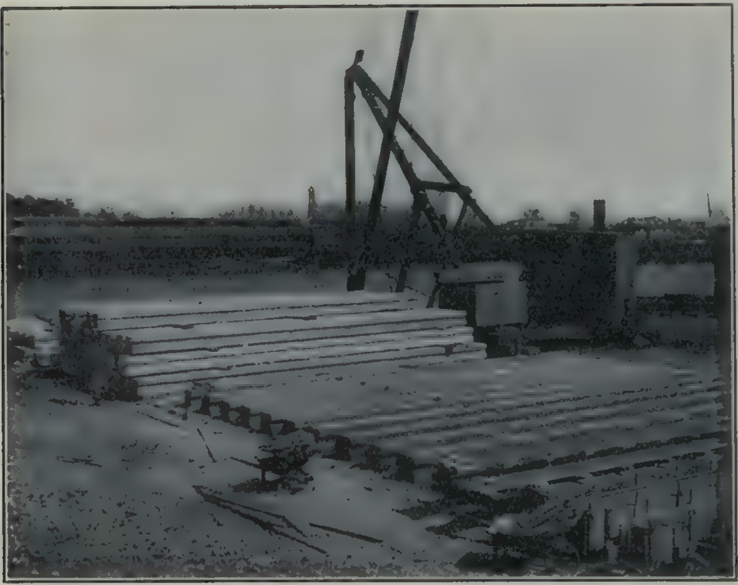

Fig. 13.—Moulding yard for reinforced concrete sheet piling, Baltimore, Maryland.

Fig. 12 shows the piles for supporting pier No. 8, built by the U. S. Bureau of Yards and Docks at the Navy Yard at Puget Sound, Washington. Hollow cylinders of reinforced concrete having an enlarged base are placed in position and filled with gravel, stone or concrete; on them the structural supports of the pier of reinforced concrete are constructed. Similar hollow cylinders were used in the construction of the wharf at Fort Mason, San Francisco. In this case a wooden cylinder was placed in position, filled with concrete, and the shell was removed after the concrete had properly hardened. Upon these concrete pillars the superstructure of reinforced concrete was placed.

Another use of concrete for timber work exposed to sea water is to encase the timber with a jacket of reinforced concrete and thus protect it against the limnoria, teredo, or rot. Fig. 13 is a view of such sheathing used in the harbour improvements at Baltimore, Md. This was cast on land, and after it was properly hardened it was driven to form a tight bulkhead because of tongues and grooves in the sheathing. A feature about reinforced concrete piles is that they may be driven with much heavier hammers than are commonly used for wooden piles, and when properly cushioned they stand such driving without crushing or otherwise becoming defective. One notable instance of the severe treatment which these piles are likely to receive is the quay wall which rests on a coral reef, built by the Hennebique Construction Company, at the Navy Yard, Key West, Florida. The frequent occurrence of an intermediate crust of coral rock made it necessary to puncture this in order that the pile might have a solid bearing on the coral reef. This crust was frequently mistaken for the coral reef, and in trying to drive through this the pile was broken. These piles were provided with hoops at the butt and a cast iron shoe at the point.

Another interesting use of concrete is in the construction of dry docks, of which there are a number in this country. The constructors, however, seem to think it necessary to go to the additional expense of either facing the entire dry dock with stone (usually granite), or at least facing the walls at the entrance and at the water line. This is an unnecessary expense, as concrete can be used for the construction of the entire dry dock at a great saving in cost over stone, and with a minimum cost for maintenance. The dry dock at the League Island Navy Yard, Philadelphia, Pa., (Fig. 14), is constructed entirely of concrete.

By reason of the difficulty of constructing lighthouses at greatly exposed places, concrete has proved invaluable. Many of the lighthouses built by the United States Lighthouse Board are entirely of concrete. Some consist of heavy cast iron cylinders built with concrete. A growing practice, however, seems to be to construct

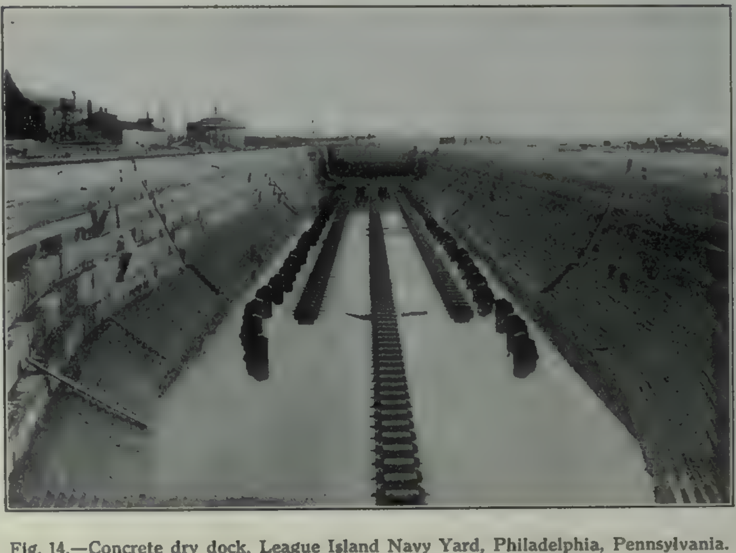

Fig. 14.—Concrete dry dock, League Island Navy Yard, Philadelphia, Pennsylvania.

a base with a pneumatic caisson of wood and build a central pier, 20 ft. or more in diameter, upon which the lighthouse is built; or to form this base in a caisson similar to that shown in Fig. 11. Such caissons can be built on shore and towed to the site, loaded with broken stone or gravel until they settle into the desired position. On this caisson as a base the lighthouse is built.

Concrete, to properly withstand the action of sea water, should be allowed to harden before it is subjected to the sea water. Where the structure is constructed in the open sea, this is almost impossible, and it is therefore necessary to protect it against the sea. The difficulty of constructing concrete work in the sea, where it is subjected to tides and storms under conditions by which it is completely submerged, is easily understood, and it would seem desirable that such structures should be built, whenever possible, of blocks of concrete moulded on land and allowed to properly harden before being placed in position.

A great deal has been said concerning the disintegration of concrete in water, especially sea water. In fresh water the disintegration is the result of frost action, and takes place between the tides. This is likely to occur where the concrete is porous and is lacking in density. With concrete properly mixed and hardened, and of the requisite density, there is little or no damage from frost. In sea water this is equally true. It was formerly the general practice throughout the world to mix concrete quite dry, i.e., so that the water would just flush to the surface under continued tamping. Permeable structures resulted, which permitted the surrounding water to penetrate to the interior of the mass, especially in that portion between the tides, where there was danger of disintegration from frost action. However, it is perfectly practicable to build structures of concrete or reinforced concrete in fresh and alkaline water that will not be damaged in any way by the action of frost, sea water or other alkalies.

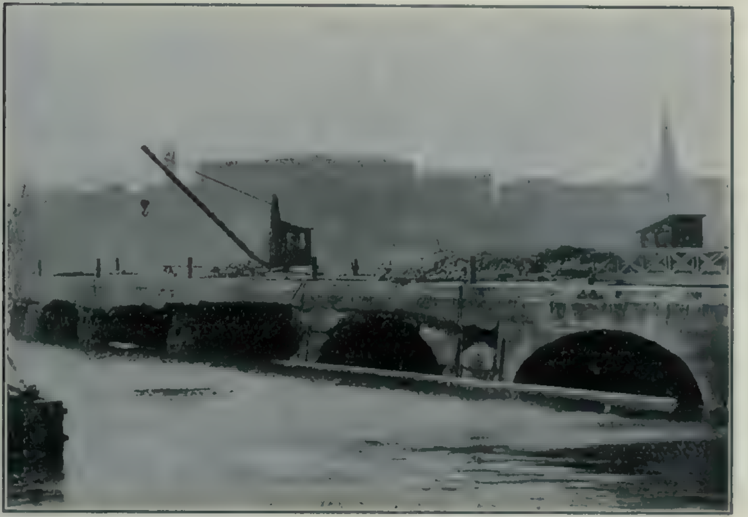

Fig. 15.—Pier No. 1, Navy Yard, Boston, Massachusetts.

The view (Fig. 15) of Pier No. 1 of the United States Navy Yard at Boston, Mass., shows clearly the effect of properly and improperly mixed and placed concrete. Rear-Admiral Richard C. Hollyday was in charge of the Boston Yard at the time this pier was constructed in 1901-1902 and he informed the speaker that the two portions were by different contractors, the same material having been used in both portions. The concrete in the inner end was mixed fairly wet, while that of the outer end was dry concrete of a leaner mix. The resistance between tides of the two concretes is evident, that on the right side of the picture being unaffected while the other is badly disintegrated; the submerged portions of both were practically undamaged. The lesson taught by this experience is that well-proportioned, dense concrete will withstand the action of sea water where lean, dry mixed concrete will fail. Inasmuch as many of the earlier structures were built of dry mixtures, the resulting permeable concrete has shown the effect of frost between tides. The writer has found in his investigations that almost universally the disintegration of concrete takes place between high and low water, and has never found an instance of the disintegration of submerged properly proportioned dense concrete. It has also been his experience in the tropical waters where there is no frost action, that concrete of reasonable density is unaffected. After disintegration of the concrete has started through frost action, there is undoubtedly some chemical action of the sea water on the concrete. The speaker has never found an authenticated instance where concrete had disintegrated from the chemical action unless it had been permeated by sea water before it had set.

In Wyoming, Montana, and the Dakotas, where the soil is impregnated with alkali, disintegration of concrete has occurred at the ground water line. The ground water is drawn up by capillary action and the rapid evaporation of this water and consequent rapid crystallization in the pores of the mass destroys the bond, and results in complete disintegration. Under these conditions, stone and brick and other building materials are similarly affected. This is notably so in the vicinity of Great Falls, Montana, where stone buildings, brick sewers and similar masonry structures are largely destroyed by this action.

An important matter in the erection of reinforced concrete buildings in salt air is the proper protection of the reinforcement—for the reason that the corrosion of the improperly imbedded metal may result in serious damage to the structure. At Atlantic City, N.J., one of the large piers has been seriously damaged because of the use of a porous aggregate which permitted moisture and air to reach the reinforcement and the corrosion of this has has stripped the concrete from it. The aggregates, therefore, under such conditions should be hard and dense, and so proportioned as to secure a concrete of maximum density.

The Author's Conclusions

The writer's visits to the various laboratories of Europe, and the results of the tests conducted by him and others, lead him to the opinion that where concrete is properly proportioned, mixed and placed so that the resulting mass is of maximum density it affords ample resistance to the action of both fresh and sea water—especially if sufficient time is given the concrete to harden before its subjection to this action. He is further of the opinion that good practice demands that concrete shall be mixed a sufficient length of time, without too much water, so that there results a mass of viscous consistency which will flow readily and in which the ingredients will not separate. Increased mixing of concrete develops colloids, and results in a sticky, viscous, dense, impervious mass, which will shed water and produce a concrete of maximum strength and resistance to the action of both fresh and sea water.

Principles Governing the Study of Public Water Supplies*

By Percy Griffith

THE design of underground works is a matter requiring much consideration and extensive experience. In every case the engineer has a certain number of conditions presented to him, among which a certain proportion are unknown and subject to more or less reasoned speculation. Now, however speculative may be the conditions governing the water supplies in upland gathering grounds, those involved in problems of underground water are infinitely more so, and the proportion of unknown factors is enormously greater; nothing, therefore, but extended experience (including many failures) can qualify an engineer to advise on questions of underground water supply. At the same time, no subject is more fascinating to one with sufficient energy, determination and patience to carry him through the initial difficulties and disappointments which are the essential preliminaries of a successful practice.

Broadly speaking, underground water-works may be classified as follows: (1) Shallow wells for tapping subsoil water; (2) deep water wells for tapping deep-seated reservoirs; (3) wells with artesian borings to tap deep-seated streams; (4) borings (either with or without chambers or wells to take the pumps).

(1) **Shallow Wells for Subsoil Water.**—In the first of these the greatest difficulty to be provided against is the pollution of the water, and it is important that the well should be made perfectly watertight for such a depth as may be necessary to filter out impurities drawn in at the surface. The water will then be unable to get access to the well until it has passed through a sufficient depth of the subsoil to filter it effectively. This depth will vary, according to the nature of the pollution, the character of the subsoil, and the rate at which water is abstracted. In some cases water is collected in surface gravel beds by means of drain pipes laid with open joints, but unless the area drained by this method is carefully preserved from pollution at the surface, it is a dangerous system of collecting water intended for domestic use.

There are several methods of making wells watertight, the most efficient (and the most expensive) being to line them with cast-iron cylinders, which can be cast in rings up to 4 ft. diameter, but beyond this size are best made in segments with vertical joints. The vertical flanges are, of course, useful and necessary in any case as stiffeners. Cast-iron cylinders are, however, more generally used in deep wells, and their application will be more fully described under that head.

The more common method of making shallow wells watertight is to line the excavation with a single ring of brickwork (in some cases specially moulded bricks being employed), and to pack the space behind with concrete. The face of this ring is then rendered with cement mortar about 1 inch thick, and another ring of brickwork is then built up as a protection to the mortar. As brickwork must be built upwards, it is necessary in such cases to suspend in the well a temporary ring or kerb on which the brickwork is supported until the packing behind provides sufficient bond to prevent it slipping down the well. In cases where the sides of the excavation are liable to fall in, it is necessary to fix a temporary lining of timber, which is removed as the brickwork proceeds. It is also better to erect the brickwork in sections rather than to rely upon timbering for any great depth.

Watertight work can also be obtained by laying a two-brick ring in one operation with cement mortar joints and backing, but the former method is generally preferred.

(2 and 3) **Deep Wells (with or without Borings).**—In deep wells the chief difficulties arise through the variations of strata passed through. Thus a narrow band of fine wet sand will make it almost impossible to carry out the lining in brickwork; indeed, any sandy or loose strata will involve difficulties in supporting the excavation while brickwork is built up. In such cases cast-iron or wrought-iron cylinders are used, and these must be driven down from above. The tendency of the surrounding material to close in behind the cylinder will sooner or later make it impossible to force the cylinders down beyond a certain depth, and at that point cylinders of smaller diameter must be inserted inside the upper section until in turn these become fast, when a further reduction of diameter must be made. Should a solid bed of clay be subsequently met with, it is possible to resume lining with brickwork, and in that case the diameter can be increased to provide facilities for fixing pumps and space for giving access thereto.

I have separated wells tapping underground reservoirs from those having borings carried down from the bottom, because they apply to different geological conditions. In the former case the water does not rise when tapped, as it has no "artesian" head, and the well is merely carried down into a reservoir such as would exist where it was sunk wholly through the water-bearing stratum from which the supply is to be derived.

In the second case (wells with borings) the well is merely constructed to enable the pumps to be fixed below the water level, and the water is tapped by means of a boring driven from the bottom. This arrangement is applicable only where the water is under an "artesian head"—that is, when it is tapped below the "line of saturation," and therefore rises up the boring when the superincumbent impervious bed is perforated.

A striking example of this kind of well was carried out by me for the Lincoln Corporation; the well was carried down in impervious clay to a depth of 1,500 feet, and at 1,560 feet the boring (which was ultimately carried to a depth of 2,020 feet) tapped water, which immediately rose up the well until it overflowed at the surface.

(4) **Borings.**—It will be realized that in sinking wells in water-bearing strata it is necessary to pump out the inflowing water continuously to enable the men to excavate the material and construct the lining. This frequently constitutes a large item of expense, and it is then necessary to consider the alternative of boring, a process not only less costly and quicker than well-sinking, but one which is carried out entirely

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* From a lecture delivered recently before the Birmingham University Engineering Society.—Concluded from last issue.

from the surface, thus avoiding the risks of accident inseparable from work underground.

The head gear used in sinking the well and driving the boring at Lincoln, already referred to, is known as Mather & Platt's machine. The essential feature of this apparatus is the use of a flat hemp rope for suspending the boring chisel, and raising and lowering the "shell." This rope is wound on a drum which is operated by an engine fixed on the rear framework of the machine. The process of boring consists of two distinct operations; the first is the reciprocation of the boring chisel, which was in this case 24 ins. in diameter when the boring was at its greatest depth (2,020 ft.), and consisted of a circular disc of steel perforated with holes in which are bolted a number of steel chisels, the disc being suspended at the end of a steel rod or vertical shaft about 12 ft. long and from 5 ins. to 6 ins. in diameter, on which a skeleton disc is fixed near the top to form a guide. During this operation the drum is fixed in a stationary position, and the rope is clamped to the frame of the machine so that the chisel will just reach the bottom of the boring. The rope is passed over a pulley fixed on the upper end of a ram working in a vertical steam cylinder so that the admission of steam to this causes the pulley to rise, carrying the rope and suspended chisel with it. When this has been raised a certain height (depending on the nature of the strata being bored through) the steam is released, and the weight of the chisel (this one weighed several tons) carries the rope, shaft and tool to the bottom with a force proportional to the amount of "fall" allowed. This operation is continued for periods varying with the progress of the boring—that is, until sufficient material has been excavated to impede the working of the chisel.

The drum is then operated to wind the rope and chisel to the surface, the chisel is detached, and the "shell" substituted. This is merely a large steel cylinder fitted with a hinged bottom opening inwards. This is lowered to the bottom and reciprocated for a few minutes, after which it is drawn rapidly—that is, much more rapidly than the boring chisel—to the surface, and its contents discharged into wagons for removal to the tipping place. This is repeated until the foreman in charge is satisfied by the feel of the rope that the loose material has been removed, when the chisel is again lowered, and the cycle of operations is resumed as described.

Although this description applies to a boring of rather unusual dimensions, the process adopted is that in most common use for deep borings, except that the flat rope enables the chisel to be automatically revolved at each stroke, whereas when ordinary circular rope is used the tool has to be revolved by manual labor. For smaller borings steel rods are used in place of ropes, but these have to be lifted in sections, unscrewed, and slung aside every time the tool is raised for "shelling" out the debris, and replaced when the "shell" or chisel is lowered.

As the boring proceeds it is necessary to drive down steel (or, in some cases, cast-iron) tubes to prevent the sides from falling in, and, as in the case of well cylinders, these will sooner or later become jammed by the closing in of the surrounding strata. When this occurs, it is necessary to insert a line of tubes of smaller diameter, and in some cases a considerable number of such reductions is necessary before the full depth can be attained. As the work proceeds each separate line of tubes must be provided of the full depth of the boring, so that it can be forced down from the surface, but on the completion of the work each section of tubing can be cut off at such a point as will provide a lap of about 20 feet in the next largest section. If, however, there is any risk of polluted water passing through the junction into the boring, the inner and smaller lining tubes must be left in for the full depth.

PUMPING MACHINERY

As the question of pumping machinery is in itself a distinct branch of mechanical engineering, and to that extent lies somewhat outside the sphere of the civil engineer, it is hardly possible for the water engineer with a general practice to master thoroughly all the details involved in the design and construction of boilers, engines, pumps and their accessories. The engineer in charge of a works where pumping machinery is in use must, however, devote his attention to at least the broader elements of the subject, and he will, by virtue of his responsibility for the economical upkeep of his plant, be compelled to master thoroughly the details of the machinery under his care. As, moreover, he will at intervals be called upon to advise as to the extension, removal, or improvement of the plant at his works, he must keep himself thoroughly up to date as regards the relative efficiency or other advantages or disadvantages of different designs of pumps and motors for operating them. The consulting engineer, having possibly no works under his constant supervision, must lose no opportunity of collecting experience and information as to the results obtained with various types of plant under different working conditions. For all alike it is extremely desirable that the early training should include service in the shops of a firm manufacturing pumping machinery, as by no other means can the mind be educated to that intuitive grasp of mechanical problems which is essential to secure independence of judgment. Without such training it is also very difficult, if not impossible, effectively to superintend work carried out by such firms, and such inexperience must be paid for, directly or indirectly, by the employer or client.

Classification of Plant

As there is almost endless variety in the types of pumping plant in use for water-works, it is out of the question for me to do more than briefly outline the main sub-divisions into which the subject may be classified.

Broadly, these are:—

(1) Surface pumps (low and high lift).
(2) Well pumps.
(3) Borehole pumps.

And for motive power:—

(a) Steam engines (direct acting or geared).
(b) Internal combustion engines (gas or oil).
(c) Electric motors.
(d) Air lift (including compressing plant).
(e) Water wheels and hydraulic motors.

(1) **Surface Pumps.**—For low lifts and proportionately large deliveries, the single centrifugal pump is very convenient, mainly on account of the absence of valves and the high speed at which they are run, thus allowing them to be coupled to high-speed motors without the interposition of gearings. It is, however, rarely the case that water-works can be supplied by low lifts, and the application of this type of pump is therefore very limited.

Another special pump suitable for low lifts is the "Humphrey" internal combustion pump, of which a very striking example is at work at the new Chingford reservoir of the Metropolitan Water Board. This is a combination of engine and pump in one piece without pistons, buckets, gearing, or any close-fitting parts whatever. It operates by a cycle similar to that known as the "Otta" cycle—that is, (a) the explosion chamber is charged with the proper proportion of air and oil vapor drawn in (in this case by the movement of a body of water), (b) the mixture is compressed (in this case by the return movement of the water), (c) the explosion of the mixing expels the water and elevates it to the point of discharge, and (d) the explosion chamber is swept clear of the products of combustion (again, by the pendulum-like action of water).

For high lifts the plunger pump is most suitable, as this lends itself to any variety of condition, both as regards space occupied, position (horizontal, vertical or inclined) and type of motive power. The term "surface pump" may be applied to any case where the pumping level of the water is within 25 feet (vertically) of the surface, as under such circumstances the pump itself can be fixed on the ground level.

(2) **Well Pumps.**—In three-throw bucket-and-plunger pumps, suitable for fixing in well at depths of from 50 ft. to 100 ft. below the surface, the pumps are operated by steel rods carried in suitable guides fixed to the side of the well, the reciprocation being given by a crank shaft with three cranks set at an angle of 120 degs. to one another. The delivery of water is thus almost constant throughout the revolution, and this type of pump is very popular on account of the absence of shock in the rising main due to this cause.

(3) **Borehole Pumps.**—Where it is decided to dispense with a well it is, of course, necessary (unless the pumping level of the water is within 25 ft. of the surface) to fix the pump in the boring. This limits the design of the pump to two types—viz., the single-acting bucket pump and the "concertina pump" (double acting).

One modern development of borehole pumps must be briefly mentioned, and that is the multiple-centrifugal pump. This consists of a series of centrifugal pumps revolving on a common axis or shaft. The water passed from the outlet of one to the inlet of the next acquires an increased pressure at each stage, and by this method high-speed engines or electric motors can be applied to this type of plant without the need for gearing of extravagant proportions.

VARIOUS TYPES OF MOTIVE POWER

This subject is extremely fascinating, because it involves so many points which interact upon one another and which, considered separately, may produce results altogether contrary to those which result from the combination of all. This may be best illustrated by a brief reference to the various types I have enumerated.

(a) **Steam Engines** are even yet the most reliable machines for driving pumps, and in large installations the fuel economy obtained with them compares favorably with that obtained with any other more modern system. In cases where, owing to the gradual falling off of the yield of water, it is desired to run the pumps at slow speeds, the steam-driven pump is the only one which will meet the case economically and efficiently.

(b) **Internal Combustion Engines** offer the greatest attraction in regard to fuel economy and first cost, and for small works they must be considered as generally the most suitable. Gas engines operated by independent producer-gas plants give remarkable results as regards fuel economy, and although this advantage is somewhat discounted by the stand-by losses and the cost of maintenance, experience has now proved the system to be very well adapted for small waterworks.

The oil engine has also proved a very convenient motive power for small rural works, as the supervision required is reduced to a minimum, but in recent years the invention and development of the Diesel engine has given this type of power an advantage over other internal-combustion engines. The fuel economy has been greatly increased, and the larger sizes of plants have given results which bid fair within a short time to exceed those obtained with every other type of plant. (The application of this system to marine propulsion will no doubt be known to all present). Nevertheless this, like every other internal-combustion engine, must be run at high speeds, and for this reason it is not applicable to the ordinary types of pump, except by means of elaborate systems of gearing, which, by their cost, friction losses, and excessive wear and tear, largely discount the initial advantages offered by the engine.

(c) **Electric Motors** are, of course, often applied to pumps, but, except with centrifugal pumps, their high speed involves the use of gearing, and unless electricity is available at very low cost, or other power is not available, electric motors are not often employed for pumping.

(d) **Air-lift Plant.**—This is a very convenient method of raising water from deep borings, particularly for temporary purposes, such as testing the yield, or removing accumulated sand and debris. It has the advantage of dispensing with valves and working parts in the borehole. It is also convenient in cases where water has to be drawn from a number of borings in the same neighborhood, for a central power station can provide compressed air sufficient for all, and so avoid the establishment of a separate works at each boring. It has, however, the disadvantage that the average fuel cost is about three times that of any other type of pumping machinery; moreover, the air pipe must be immersed to a depth below the pumping level almost equal to the height to which the water has to be lifted; thus the boring must (in many cases) be carried to a depth much greater than otherwise required.

(e) **Water Wheels and Hydraulic Motors** (including therein turbines) are occasionally convenient methods of operating pumps, particularly in cases where pumping stations are situated adjacent to large rivers. Examples can be seen at Reading, Windsor and Guildford, but this type of motor is better suited to countries where water power is more liberally provided by Nature than it is in the United Kingdom, and in such cases it is usually found more economical to utilize the water power for generating electricity, which in its turn can be applied to all industrial purposes with almost equal facility.

In the finished iron and steel trades of the North of England the prices of several descriptions have been advanced 10s. a ton. Common iron bars are now £11 10s., iron ship angles £11 10s., steel sheets (single and double) £11 15s. to £12, steel strip £10 15s., and basic bars £11 15s.

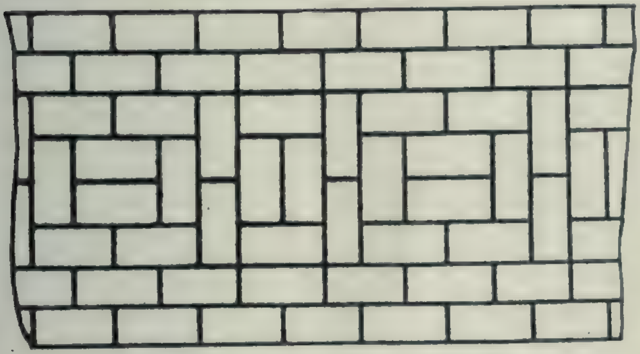
The Rectilinear System of Laying a Brick Walk

IN planning a brick sidewalk, or, more properly speaking, a brick walk, a great deal may be accomplished in the way of a bond. In point of fact, says The Brick and Clay Record, the brick walk lends itself to pattern-work more readily than ordinary brick-work, since there are no piers to be figured and no openings to interrupt the pattern.

A noted landscape architect advocates what he calls the "rectilinear system," a "system" which appears to be formal at first sight, but when multiplied loses much of this feeling. Incidentally, it agrees with the present architectural mode, which places a rectilinear structure on an quadrangular lot.

There is a great deal of reason, therefore, in the objection to curved lines in the plotting, since there is a total lack of harmony between the curves and the straight lines of the house—not to mention the boundaries of the garden. The rectilinear plan lends itself to a better spacing of the walk and border on one hand, and the natural informality of vegetation on the other is a source of charm in itself.

W. S. Rogers, who advocates the "rectilinear system," shows that the cost of a brick walk compares favorably with that of a gravel walk, tile edged. He suggests the use of brick on edge or one end for a raised curbing to the main walk. A sand joint he considers satisfactory in many situations, but a cement joint better, as it precludes seepage of moisture from below and prevents the growth of weeds in the crevices.



The rectilinear system of laying a brick walk.

Wide use of vitrified brick, not merely underfoot, but in such vertical structures as walls, terraces, posts, foundations, and in the house itself, is one of the triumphs of architectural originality in the present day. Strength, symmetry and beauty of texture are combined in a striking degree in this material, which seems capable of endless adaptations. In contrast with other materials used for walks and drives, its first and most striking attribute is cleanliness. There is no loose material to be picked up on muddy feet and carried into the house. A stream of water from a garden hose will always leave it as bright and fresh as the day it was laid.

One of the prime considerations in laying a path is to have it go somewhere. It naturally leads from the residence and just as naturally it should terminate in a summerhouse, a seat, a pergola, or even a toolhouse. A second cardinal point in path location is the proper distribution of space for planting on either side of the walk.

The side toward the sun should be reserved for a narrower flower border, of even height, beyond which a grass plot or lawn may be most effectively located Individual taste will dictate different relationships of plant, shrub and grass, but the scheme does not begin to emerge from a state of chaos until it has a pathway, clean cut, harmonious and direct, to set off the avenue of bloom, and to give accessibility to each of its many petalled attractions.

Joint Fillers for Granite Block*

By Clarence D. Pollock†

THE requisites of a good filler are, that it should hold the blocks firmly in position, remain permanently in place, afford support to the edges of the blocks and thus prevent chipping and consequent rounding of the tops of the blocks. It should be easy to apply, reasonable in price, and a material which will permit of traffic directly after it has been placed in the joints of the pavement.

Portland cement grout complies with all these requirements except the last. This is a very considerable defect on important streets in the larger cities, and in general prevents its use in such places. But wherever the conditions are such that the work can be blocked off for the proper setting of the cement, both in the first construction of the pavement and whenever trenches are repaved, a Portland cement grout, conscientiously made and applied as specified in the standard specifications of this society, will give most satisfactory results. It is necessary to pay very close attention to the details in order to insure uniformly good results. In general, a machine-mixed grout is much better than one mixed by hand. If the work is carried on under a hot summer sun, the surface should be kept moist by sprinkling for at least three or four days after the grout has been poured. Sand or earth spread over the pavement and sprinkled with a hose every evening is a good method of "curing" the joints. Grout joints cannot be made satisfactorily in cold or freezing weather.

Bituminous fillers overcome the faults of a cement filler, but they have faults of their own. One that is suitable in the summer season is usually too brittle in the winter, and it breaks out under traffic. The bituminous fillers given in the society's granite specifications are used in combination with fine gravel. This has not proved a very efficient method of filling the joints. In using fine gravel, the bituminous filler tends to mat on top of the gravel, and does not go down into the small voids in the gravel. Traffic picks out the filler from the top of the joint, and then the joint is little better than the old style sand one. Much better results have been obtained by using coal tar pitch, asphalt, or a mixture of the two, in combination with sand, the sand not to exceed fifty per cent. of the total.

The writer has obtained better results with asphalt fillers, and mixtures of asphalt and coal tar fillers than with tar alone. It seems to be practically impossible to obtain a straight gas-tar filler which will not crack and be brittle in cold winter weather if it is not too soft in hot summer weather. The old mixture of 100 parts of coal-tar pitch and 20 parts of asphalt, which was used as long as twenty years ago in Brooklyn, has given much better results in work which has come under the observation of the writer than the straight coal-tar pitch. Good results have been obtained with straight asphalt fillers also.

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* From a paper read before The American Society of Municipal Improvements.

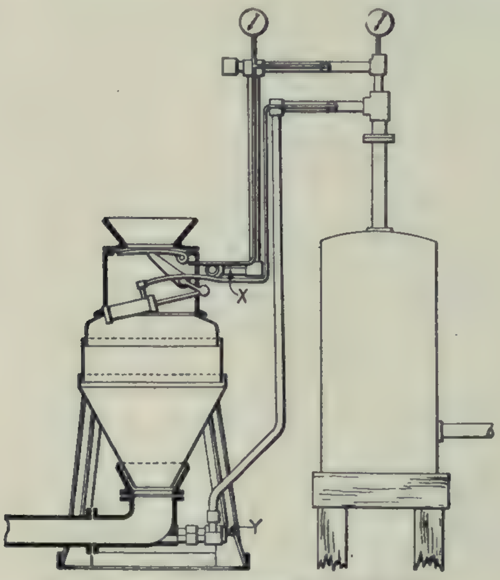
†Consulting Engineer, New York City.

It is desirable that experiments be tried using various mixtures of asphalt and coal-tar pitch, and also using straight asphalts in combination with as much sand as the bitumen will carry satisfactorily

There is demand for a bituminous filler that will flow into the joints readily, and stay there permanently. It should have sufficient body when cold to give a fair amount of support to the edges of the granite blocks, and protect them from the abrasion of heavy metal tire traffic. The mixture with hot sand before pouring has been a great help in improving the bituminous filler. The next step should be a determination of the proper bitumen or mixture of bitumens.

Proper Regulation of Air Prevents Clogging of Pneumatic Mixers[*]

PROPER application of an ample supply of compressed air has overcome clogging in the conveying pipe in placing concrete by the pneumatic method. This clogging has been the most serious drawback to the use of this method by mixing and placing concrete, which has developed until concrete has been placed at a distance of 2,800 feet at the Mile Rock tunnel in San Francisco, and raised to a height of 60 feet in building piers for a bridge at Magnolia, W. Va.



How to admit air to pneumatic concrete mixer.

Owing to the way in which different aggregates behave in feeding into the conveying pipe, the air has to be supplied differently for stone and gravel. The illustration shows a cross-section of the mixer and inlet pipes, which are designated by X and Y. To illustrate the above statement, when gravel is used, it has been found that it was necessary to admit air only through the inlet marked Y, as an application through both would cause the material to feed too fast into the conveying pipe, and would result in a clogged pipe. When stone is used, however, it is necessary to apply the air through both inlets. If only the inlet Y is used, the material will arch and then suddenly fall down to the discharge pipe, causing it to clog.

It is very important to have a sufficient volume of air to carry the concrete through the delivery pipe to the forms. When this has not been properly taken care of, the concrete will drop in the delivery pipe and the next batch will stick on this and clog the pipe. The tendency has been to underestimate the number of cubic feet of free air a minute required, as till lately there has been little information available on this subject. The following table shows the result of sent satisfactory installations are proving the correctness of these figures.

Cubic Yards of Concrete Per Hour, Mixer Capacity ½ Cu. Yd.

Actual amount of compressed air required. Cu. ft. of free air per minute	Length of Horizontal Discharge					
	100 Lin. Ft.	300 Lin. Ft.	400 Lin. Ft.	600 Lin. Ft.	800 Lin. Ft.	1000 Lin. Ft.
600	20	15	10	..	..	..
800	30	20	18	12	6	..
1200	40	30	25	20	12	8

It has been found that the character of the sand plays a more important part, with reference to the speed with which the mixture is carried through the pipe, than does that of the stone or gravel. A sharp, clean sand will require less air to move concrete mixed with it than one in which the percentage of loam or oxide of iron is high.

It has also been found that a pressure of 90 lbs. to the square inch gives the best results. This pressure, expanding into a 6 or 8-in. pipe, depending on the size of stone or gravel used, is reduced to a pressure averaging about 25 lbs.

This high pressure has presented an obstacle to be overcome, as the delivery end must be securely fastened to take care of the kick resulting from this pressure. After considerable experimenting, it has been found that a hose, the lining of which is made of pure rubber to withstand the wear, and reinforced to take care of the thrust, when connected a short distance from the delivery end, acts as a shock-absorber, and allows the discharge end to be handled, so that the concrete is not all deposited in one place, but may be distributed in even layers.

The mixture of the concrete placed in this way has been found to be as perfect as that delivered by any of the mechanical mixers on the market. When, however, the volume of compressed air falls below the amount required, as shown in the table, the mixture shows a tendency toward segregation.

The pneumatic method is well adapted to tunnel lining, as it is possible to secure an increase of at least fifty per cent. in speed with a corresponding decrease in labor. Accurate cost data are difficult to get, but the following represents the average case:

	Costs per cubic yard
Labor	12
Compressed air	20
Pipe and equipment	10
Overhead	3
Cost for mixing and placing	45

The usual labor crew consists of six men for an outfit which is placing concrete at the rate of 100 cu. yds. in a ten-hour day.

A United States ruling has it that a partnership is not barred from claiming a mechanic's lien on a building merely because one partner, in his individual capacity, was surety on the contractor's bond, and had guaranteed the delivery of the building free of liens.

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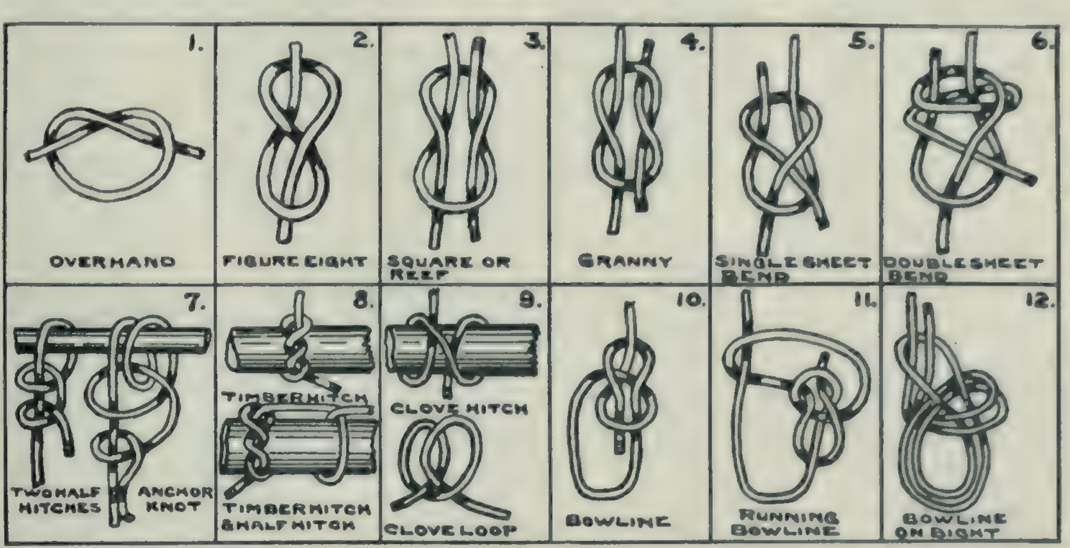
[*] By H. A. Leeuw in The Engineering Record.



CORRECT DESIGNATION OF VARIOUS KNOTS.

The efficiency of knots in Manila rope, according to Prof. E. F. Millar, of the Massachusetts Institute of Technology, is as follows: rope dry (four tests) 100; eye splice over thimble, 90; short splice in rope, 80, timber or half hitch, 65; bowline knot or clove hitch, 60; sqnare knot or sheave bend 50; overhand knot, 45.

Highway Improvement in Quebec

THE Montreal-Quebec highway which is now being constructed by the Quebec Government is declared to be one of the best roads in the province. The distance from Montreal to Quebec is one hundred and eighty-five and one-half miles. Of this distance one hundred and twenty-five and one-half miles are in excellent shape. The remaining portion is not quite finished, but in many cases the foundation has been laid and all but the top dressing completed. It is expected that only about fifteen miles will be left over until next season. A tour over the road was made recently by H. G. Pillow, President of the Automobile Club of Canada, who covered the whole distance of one hundred and eighty-five and one-half miles in six hours and forty minutes.

With the completion of this road and the King Edward Highway, motorists next season will be able to make a tour of over seven hundred miles through Canadian territory, over good roads. Starting from the White Mountains, from Bretton Woods, they can travel to Skowhegan and over to Jackman in Maine, and then cross the border into the province of Quebec ninety-two miles from the city of that name, reaching the latter place along a good gravel road to Levis, crossing to Quebec, travelling over the new highway to Montreal, and then proceeding via the King Edward Highway to Rouses Point and back to the White Mountains, through scenery which is as magnificent as it is varied.

The putting of a binder on the King Edward Highway has been commenced, and the work is proceeding under the direction of an engineer of the Department of Roads. For years those interested in the road and in automobile traffic have urged that something be done to preserve the surface. A start was made on Thanksgiving Day at Napierville. The material is supplied by two Kinnear pressure wagons, and it is hoped that the work will be completed by the end of the month. The recent repairing and rolling of the highway has made a good surface, and when the binder is finished the King Edward Highway will have a dustless, plastic surface. The section between Laprairie and the Victoria Bridge will not be treated with the binder this year, as the surface is in such a bad condition. This section will probably be reconstructed next year.

Personal Mention

Mr. William Carless, Lic.R.I.B.A., of Turner & Carless, Montreal, has decided to return to England for the purpose of going to the front.

Mr. George T. Dodge, of the Quebec Public Works Department, Sherbrooke, has obtained a commission in the 87th Regiment, Grenadier Guards.

Mr. Thomas Adams, Town Planning expert to the Commission of Conservation, attended a Norfolk County Town Planning Conference held recently at Simcoe, Ont.

John Jackson, a plastering contractor of Riverdale, Toronto, died last week. Mr. Jackson was born at Leeds, England, fifty-seven years ago. Five of his sons are now serving with the Colours.

Mr. R. O. Wynne-Roberts, consulting engineer, formerly of Regina, now of Toronto, was elected Honorary President of the Regina Engineering Society at the annual meeting of that body held recently.

Mr. J. A. Cunningham, President of the B. C. Manufacturers' Association, states that a two million dollar shell contract has been awarded to the west—300,000 shells for Vancouver, 200,000 for Victoria, and 150,000 for New Westminster. Mr. Cunningham says that the Shell Committee has given one year's time for the fulfilment of the contracts.

Mr. F. G. Evans, of Saskatoon, formerly Superintendent for the contracting firm of Smith Brothers & Wilson, of that city, left Saskatoon recently for Vancouver to join the new Pioneer Battalion that is being recruited in Western Canada. Mr. Evans is joining "A" Company, in which Mr. John H. Cahan, a civil engineer formerly of Saskatoon, holds a commission.

One of the recent developments in the way of builders' hardware is a screwless hinge, which has two steel projections on each end. On the end next to the door stop there is a straight steel projection that enters the wood, and on the other end of the hinge there is a clamp projection that enters the door casing. These projections or hooks counteract and offer the same resistance and holding force that the screw offers to the hinges.

Mainly Constructional

In the city of Quebec construction is on the increase. Last month the permits were valued at $284,560, against $125,544 a year ago. The total permits for the year to date represent $1,914,926.

Contracts for 150,000 shells have been awarded to New Westminster, B. C. The distribution to local machine shops will be made through the Vulcan Iron Works, of which Mr. J. R. Duncan is the Managing Director.

The Standard Steel Company, Limited, has been incorporated with a capital stock of $200,000 and head office at Montreal. The incorporators include L. A. David, S. H. Bush, and J. E. Elliott, all of Toronto.

At Renfrew, Ont., an ammunition factory is to be established by O'Brien's Munitions, Limited, a concern incorporated recently with a capital of two million dollars. It is understood that M. J. O'Brien, the well-known contractor, is investing half a million dollars in this enterprise.

Victoria firms have just been awarded contracts for the manufacture of 200,000 shells, according to E. Westley-Newton, Secretary of the Victoria Branch of the British Columbia Manufacturers' Association, who was one of a committee sent to Ottawa with a view to obtaining this business.

Mr. Nantel, Superintendent of the Montreal Incineration Department, has recommended the Board of Control to construct an incinerator with a daily capacity of 500 tons, replacing the present plan of dumping garbage into old quarries in the east, with an incinerator in the west end. The estimated cost is $200,000.

Excellent progress is being made on the new North Toronto Union Station, which is being built at a cost of one million dollars. The stone for the building has been arriving in large quantities from the quarries near Winnipeg. The engineer in charge, Mr. J. Ripley, expects the roof to be on by Christmas, and the building to be opened by Dominion Day.

At a meeting of the Victoria Branch of the Canadian Society of Civil Engineers a winter programme of technical papers was arranged and a special committee was appointed. It was decided to exchange papers with the Vancouver Branch during the coming session. The first of the winter receptions of the Victoria Branch was scheduled for Friday, October 22.

According to a report prepared by Mr. W. A. McLean, Chief Engineer of Highways for the Province of Ontario, the cost of a road for the twenty-six miles from the limit of Toronto to the limit of Oshawa would be $310,000. It is proposed to make the road 26 feet wide, 18 feet of macadam with a 4-foot gravel shoulder on each side. The report, which was submitted at a meeting of the Kingston Road Improvement Committee held at Whitby, also apportioned the cost Toronto would bear at 30 per cent. and the province probably $4,000 a mile. The municipalities' share would be $2,500 a mile.

The Jas. McDiarmid Company, contractors for the new Manitoba Parliament Buildings at Winnipeg, presented their first progress estimates last week. They report $28,000 expended for labour and about the same amount for material. An average of 350 men has been employed for a couple of months. During this time 2,000,000 bricks have been laid, and the stonework is being advanced rapidly. On the whole, the work is considered to have made good progress. The two ends of the north wing are now under cover and boilers are on hand ready to be erected. The heating mains are all installed in these two ends, so that heat can be put on when the cold weather starts and interior work carried on during the winter.

The City of Montreal have inaugurated the new civic lighting system on a part of St. Catherine Street and on Bleury Street. The lights are of the 6.6 luminous arc inverted type, on ornamental poles of special design, spaced 125 feet apart, with two lamps at important street corners or transfer points. The 186 lights replace 81 of the old arc type, suspended overhead. The contract for furnishing and installing the standards was carried out by G. M. Gest, Limited. The Eugene F. Phillips Electrical Works, Limited, supplied the cable and wiring, pot heads, lightning arresters, etc., and the Canadian General Electric Company the lamps. In connection with the removal of the poles on St. Catherine and Bleury Streets, the Council have decided to pay $23,975 as an indemnity to the Montreal Tramways Company.

Mr. R. W. Jones, Alberta Government Railway Engineer, and Mr. Ralph Douglas, Assistant Engineer, recently returned to Edmonton after a trip over the route of the Alberta and Great Waterways Railway. They left Athabasca on Sept. 15, travelled in a motor boat to House River, and thence proceeded to Fort McMurray by scow. On the return trip they walked the whole way from Fort McMurray to the end of steel, a distance of one hundred and sixty miles. At Fort McMurray they met H. V. Dardier and party, of the Vickers-Maxim Company, of London and Liverpool, who are on the way to Fond du Lac, for the purpose of prospecting for nickel. They also saw Major Hubbell, Chief Inspector of Dominion Surveys, who was on his way to Fort McKay. The present end of steel is at Mile 135, twenty-one miles north-east of Lac la Biche. The distance from the end of steel to Fort McMurray is 156 miles, and of this distance 141 miles of grading is completed, thus showing the great amount of work that has been done this season.

At the Federal Capital, action has been instituted in the local courts by the firm of O'Brien, McDougall & O'Gorman on a claim of $220,000 from the Nepigon Construction Company in connection with N.T.R. contracts. In a counter action the Nepigon Company claims five per cent. on all extras the O'Brien firm got from the N.T.R. Commissioners. The contract for 75 miles of the line north of Lake Nepigon, costing about $3,000,000, was originally awarded to E. F. & G. E. Fauquier in 1908 and by them turned over to the Nepigon Company on a 4 per cent. basis. The Nepigon Company reserved to itself the building of the road to grade level and sublet to O'Brien, McDougall & O'Gorman the work from grade level to completion, on a further 5 per cent. basis. The latter's claim is based on an alleged delay of two years by the Nepigon Company in bringing the line to grade level, and it is further claimed that some of the work was not properly done. The case will continue on Nov. 9 and promises to bring out some highly interesting evidence.

"The Cost of Pumping Water" is the title of a collection of graphical charts with accompanying explanatory text issued by the DeLaval Steam Turbine Co., of Trenton, N. J. The object of the publication is to facilitate computation of the over-all economy of different types of steam pumping units, having given the cost of fuel, steam pressure, rate of interest, cost of apparatus and other variables. At the end of the publication there is a list of representative municipal installations of DeLaval steam turbine-driven centrifugal pumps. Units of this type have been installed for capacities as large as 100,000,000 gallons a day and heads as great as 334 ft. It is pointed out that because of the low first cost of apparatus, foundations and buildings inherent in this type of pump, the total cost of pumping water is greatly reduced as compared with the much larger, heavier and more expensive triple-expansion reciprocating pumping engines.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Bertie Township, Ont.

The Township Council are considering the construction of a number of granolithic sidewalks. Clerk, M. S. Pound, Ridgeway.

Beverly, Alta.

A by-law will be submitted to the ratepayers on November 6th, providing for the construction of sewers at an estimated cost of $15,000. Town Secretary, H. W. Ormerod.

Moncton, N. B.

The City Council have decided to lay pavement on a portion of Queen Street. Engineer, J. Edington.

Montreal, Que.

Work by day labor is about to start on repairs to the Lower Level pumping station for the City Council. Architect, A. Chausse, City Hall.

Port Coquitlam, B. C.

The Town Council have passed a bylaw providing for the construction of a waterworks system at an approximate cost of $35,000. Engineer, E. H. Verner.

Toronto, Ont.

The Board of Control will receive tenders until November 9th for the construction of sewers on Adrean, Campbell, Lindner and Miller Streets. Specifications at Room 6, Works Department, City Hall.

CONTRACTS AWARDED

Burlington, Ont.

The Town Council have let the contract for concrete and iron pipe for the waterworks construction to the Canadian Contracting & Engineering Company, Bank of Hamilton Building. Approximate cost, $3,000.

Markham, Ont.

In connection with the construction of a waterworks system for the Village Council, the contract for pipes, hydrants and valves has been awarded to the National Iron Works, Ltd., Cherry Street, Toronto, and for steel tanks to Pittsburg-Des Moines Steel Company, c/o F. H. Hopkins & Company, Montreal, at $5,750.

The Pas, Man.

The following contracts for waterworks and sewer extensions have been let by the Town Council:—trenching and laying cast iron or steel watermains, North Western Construction Company; supply of cast iron or steel pipes and specials, Canadian Iron Corporation, 28 Victoria Square, Montreal, and Winnipeg; supply of fire hydrants and valves, Drummond McCall Company, 28 Victoria Square, Montreal; supply of vitrified sewer pipes, trenching and laying, Hurst Engineering and Construction Company, 406 Ashdown Building, Winnipeg.

Windsor, Ont.

The Windsor Jockey Club have let the contract for laying concrete walks to the Chick Contracting Company, McDougal Avenue.

York Township, Ont.

The Township Council have let the contract for laying asphalt pavement on Lauder and Glenholm Streets to the Barber Asphalt Paving Company, 200 Eastern Avenue, and for concrete pavement on Earlsdale Avenue to A. Gardner & Company, Goodyear Building, Toronto.

Railroads, Bridges and Wharves

Chippawa, Ont.

Permission has been granted to the Michigan Central Railway Company, Detroit, Mich., for the construction of an industrial siding for Norton Company, Short Street, Chippawa.

Drumheller, Alta.

The Canadian Northern Raiway Company, Toronto, have been authorized to construct a spur for the Premier Coal Company, Ltd.

Drummondville, Que.

The Canadian Pacific Railway Company, Montreal, have been been granted permission for the construction of sidings for the Aetna Chemical Company of Canada, Ltd.

London, Ont.

City Engineer H. A. Brazier has presented a report to the City Council estimating the cost of the proposed Egerton Street subway at $94,000, including pavement and sidewalks.

New Glasgow, N. S.

The Town Council contemplate increasing the head of water by raising the dam 5 feet. The matter is being considered by the Town Engineer, E. S. Fenser, and the Water Commission. Approximate cost, $5,500.

Nobel, Ont.

Permission has been granted to the Canadian Pacific Railway Company for the construction of sidings for Canadian Explosives, Ltd.

Quebec, Que.

The Canadian Pacific Railway Company have been authorized to build a siding for F. Canac-Marquis, Lot 2112, St. Saviour Parish.

Richmond Township, Que.

The reconstruction of an overhead highway bridge at mileage 64 is contemplated by the Quebec Oriental Railway Company, New Carlisle, Que. Permission has been granted by the Board of Railroad Commissioners.

Vaughan Township, Ont.

The Grand Trunk Railway Company, Montreal, have been authorized to build a siding and spur into the premises of the Empire Sand, Gravel & Crushed Stone Company, Lot 22, Concession 3, Vaughan Township.

White River, Ont.

The Canadian Pacific Railway Company have been authorized to build an extension to the siding of Austin & Nicholson, mileage 24.1, White River Sub-division.

Public Buildings, Churches and Schools

Bishop's Crossing, Que.

Tenders for the erection of a school will be called by the School Board either late this fall or early in the spring. Approximate cost, $5,000.

Bruce, Alta.

The Trustees of School District No. 1589 have been empowered to borrow $3,500 for the erection and equipment of a school. Brick veneer construction. Treasurer, W. Cross, Bruce.

Cranbrook, B. C.

Tenders on the erection of a hall for the congregation of Christ Church are being received by Rev. W. H. Bridge. Plans and specifications at the Rectory.

Gifford, B. C.

It is expected that work will start shortly on the erection of a Hall for the Municipal Council at Matsqui. Clerk, J. Gibson.

Mount Ryan, P. E. I.

Plans have been prepared for a chapel to be erected for Bishop O'Leary, The Palace, Charlottetown, at an estimated cost of $3,500. Work by day labor. Frame construction, concrete foundation, shingle roofing. Architects, C. B Chappell & Hunter, Des Brisay Block, Charlottetown.

Port Colborne, Ont.

Plans have been completed for the heating at the school now in course of erection, but contract has not yet been awarded. Architect, C. M. Borter, 102 Main Street, Niagara Falls.

Saanich, B. C.

The erection of an addition to the Municipal Hall is being considered. Engineer, D. W. Johnston, Royal Oak. Clerk, H. S. Cooper, Municipal Hall, Royal Oak. Approximate cost, $3,850.

St. Antoine de Bienville, Que.

Plans for interior work at the Parish Church are being prepared by P. Levesque, 115 St. John Street, Quebec. Tenders will be called about the beginning of next year. Approximate cost, $25,000.

St. Julienne, Que.

P. Brouillet, 2879 Christopher Columbus Street, is receiving tenders on all trades required in repairs to the Parish Church and Presbytery, with the exception of masonry and carpentry. Architect, J. O. Turgeon, 55 St. Francois Xavier Street, Montreal.

CONTRACTS AWARDED

Leclercville, Que.
The contract for roofing in connection with the school now in course of erection has been let to A. Fournier, Deschaillons, Que.

Milton, Ont.
The contract for electrical work at the Registry Office has been let to the Milton Hydro Electric Company.

Ottawa, Ont.
In connection with the repairs being carried out at the Collegiate Institute, the contract for steel work has been let to the Dominion Bridge Company, Carlton Chambers, and for masonry to George Crain, 285 Clemow Ave.

Outlook, Sask.
The contract for electrical work at the college which has been built for the Norwegian Lutheran College Association has been let to Whiteford Bros., 2231 Railway Street, Regina, and for painting to F. M. Crapper, Lorne Street and 11th Avenue, Regina. Material will be purchased by owners.

Palmerston, Ont.
The contract for plumbing and heating at the Post Office in course of erection at Bell and William Streets has been let to W. F. Martin, Gananoque, Ont.

Waldo, B. C.
The general contract for the erection of a school and outbuildings has been let by the Department of Public Works, Victoria, to A. McLean, Fernie, B. C. Approximate cost, $6,445.

Windsor, Ont.
Work has been started on the erection of a church hall for the Brethren Congregation. The contracts for carpentry, roofing and plastering have been awarded to F. L. Sweet, 65 Pierre Avenue, the masonry to Cross Bros., 25 Louis Ave., and the heating and plumbing to Phillip Dresch, Lincoln Road, Walkerville. Approximate cost, $4,500.

Business Buildings and Industrial Plants

Brantford, Ont.
In connection with the factory now being erected for the Brantford Cordage Company, a contract will be let shortly for the installation of a sprinkler system.

Fraserville, Que.
The erection of a restaurant building is being considered by F. Dionne.

Kingsmill, Ont.
S. Herlur has commenced the erection of farm buildings, estimated to cost $3,000. Frame construction, concrete foundation, shingle roofing.

London, Ont.
The Directors of the Western Fair are considering the erection of a Process Building at an estimated cost of $12,000. Reinforced concrete construction. Secretary, A. M. Hunt.

A. Ferguson, Hotel Columbia, is considering interior alterations to his premises. Approximate cost, $3,500.

Montreal, Que.
The transformer building at the Low Level pumping station will be erected by day labor. Approximate cost, $6,000.

A. Leduc, 262 Green Avenue, Westmount, has commenced the erection of a stable by day labor. Brick encased construction, felt and gravel roofing. Approximate cost, $3,000. Owner intends to build a private abbatoir in the spring.

Work has been started by the Mercure Hardware & Lumber Company on the erection of two stores and a residence on Rachel Street, estimated to cost $12,000. Brick construction, felt and gravel roofing.

The erection of a store and residence on De Castelnau Street has been commenced by Fred Demers, 3091 Drolet Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,200.

T. Settano, 1952 Dandurand Street, is building a store and flats estimated to cost $6,000. Brick construction.

Napanee, Ont.
The Canadian Northern Railway Co., Toronto, have filed plans of the station which they propose to build. A public meeting will be held to discuss the project.

Niagara Falls, Ont.
The ratepayers will shortly vote on a by-law providing for the establishment of a municipal bakery. Town Clerk, W. J. Seymour.

Ottawa, Ont.
Tenders on the construction of a cereals building at the Experimental Farm will be received until 4 p.m., October 29th, by R. C. Desrochers, Secretary, Department of Public Works, Ottawa. Plans at the Department.

Sherbrooke, Que.
Tenders on the erection of gas plant buildings for the City Council will be received until October 30th. Plans and specifications at office of the Engineer, Thomas Tremblay.

Toronto, Ont.
G. H. Lawrence, 49½ Helena Avenue, has commenced the erection of a hall at Arlington and Benson Streets, estimated to cost $3,000. Brick construction, shingle roofing. Smaller trades will be let.

Valleyfield, Que.
Castings Company of Canada propose to establish a forge, foundry and shell factory. A by-law has been carried providing for the loan of $25,000 for this purpose. Town Clerk, L. A. Boyer.

Westmount, Que.
In connection with the garage in course of erection for William Clark, 622 Sydenham Avenue, tenders on electrical work are being received by the general contractors, White Construction & Realty, Limited, 121 Bishop Street.

Winnipeg, Man.
E. Brayston, 867 Bannatyne Avenue, is preparing plans for a store to be erected on Portage Avenue for F. Sennan, Woodbine Hotel. Tenders will be called early this fall.

CONTRACTS AWARDED

Baddeck, N. S.
The general contract for the erection of a flour mill for the Department of Agriculture, Truro, has been let to Peter L. McFarlane, Baddeck. Concrete and clapboard construction. Approximate cost, $11,000.

Chatham, Ont.
Work is about to start on the erection of a store and residence on Queen Street for J. M. Adams, Cross and Raleigh Streets. The general, masonry, carpentry, roofing and plastering contracts have been let to George Pirrie, 249 Lacroix Street. Brick construction, concrete block foundation, felt and gravel roofing. Estimated cost, $3,150.

Eustis, Que.
The general contract for the construction of a mill for the Eustic Mining Company has been awarded to Loomis, Dakin Ltd., St. Gabriel Street, Sherbrooke. Estimated cost, $100,000.

Galt, Ont.
Work has been started on the erection of a factory for the Galt Machine Screw Company, Front Street. The contract for cement work has been let to John Roppalt, Wellington Street, the carpentry to William Hallman, Blenheim Road, brickwork to W. McKaig, Rich Avenue, plastering to W. Mogg, Brant Road, and painting to J. W. Swain, Water Street N.

Hamilton, Ont.
In connection with the erection of a factory for the W. A. Freeman Company, East Hamilton, the contract for carpentry has been let to J. Hossack, 87 Charlton Avenue W. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

The following contracts have been let in connection with the addition to the factory of the Hamilton Cotton Company, Mary Street N.:—carpentry, James Mercer, 72 Barton Street E.; steel, J. E. Riddle, 12 Ferguson Avenue; plastering, Hannaford Bros., Robinson Street; painting, Durand & Smith, 177 Walnut St. S.; heating and plumbing, A. Clark, 7 Main Street W. Electrical work will be done by owners, and masonry by the general contractor, William Yates, Leeming St.

The general contract for the erection of a warehouse for M. Lax, 94 Cannon Street W., has been let to F. Ittleman, 62 Florence Street. Previous report incorrect.

Montreal, Que.
The general contract for repairs to the store at 26 St. Peter Street for the Grey Nuns, Guy Street, has been awarded to A. Grothe, 6 Cuthbert Street.

Work has been started on the erection of a store and residences on St. Denis Street for Mrs. E. LeCavelier, 65 Cherrier Street. The contract for excavation has been let to M. Dalbec, c/o owner, the contract for foundations to J. April, 1344 Amity Street, and for stone work to L. Cardinal, 2909 St. Lawrence Boulevard.

Dupius Freres, Ltd., St. Catherine Street E., have let the contract for interior alterations and additions to a store on St. Andre Street to A. Mercure, 419 Labrecque Street. Estimated cost, $3,000.

The contract for steel in connection with the repairs to the Grand Stand at

Blue Bonnets Race Track has been awarded to the Structural Company, Ltd., New Birks Building.

Henry Morgan & Company, Beaver Hall Hill, have commenced the erection of a garage at 9-13 Park Avenue, estimated to cost $4,000. The contract for terrazza flooring has been let to Calkins-Leete, Ltd., 1013 St. Catherine Street W. Brick construction, felt and gravel roofing.

Ottawa, Ont.

In connection with the stores built on Bank Street by W. H. K. Lister, et al, the plastering contract has been let to T. H. Jarvis, 18 Fourth Avenue, and the painting to J. B. Duford, 92 Rideau St.

Quebec, Que.

Work has been started by L. D. Vezina, 156 St. Patrice Street, on the erection of a warehouse on St. Andre Street for J. B. Renoud & Company, St. Paul Street. Approximate cost, $5,000.

Sherbrooke, Que.

The City Council have let the contract for the construction of a gas plant to the Western Gas Construction Company, Cleveland, Ohio, at $30,980.

Smith's Falls, Ont.

Charles Pattimore has let the contract for the erection of a barn and outbuildings to the Metal Shingle & Siding Company, Preston, Ont. Approximate cost, $3,000. Owner will purchase steel truss.

Toronto, Ont.

In connection with the addition now being erected at the factory of the M. Langmuir Manufacturing Company, King and Niagara Streets, the masonry contract has been let to S. J. Smith, 30 Shannon Street. Brick construction, tar and gravel roofing. Approximate cost, $5,000.

The contract for painting at the factory erected for the LePage Individual Communion Cup Company, 102 Tyndall Avenue, has been let to R. J. Howe, 20 Lakeview Avenue.

The general contract for alterations to the warehouse at 111 Wellington St. W. has been awarded to J. Claxton & Company, 250 Shaw Street. Architect and owner in trust, J. G. Morton, 34 King Street W.

Work has started on the erection of three stores and apartments on St. Clair Avenue for A. Walker, 169 Lauder Ave. The contract for excavation has been let to Castill Bonviner Company, 1381 Davenport Road. Brick construction, tar and gravel roofing. Approximate cost, $20,000.

Vancouver, B. C.

The following contracts have been let in connection with the bank being erected on Grandview Street for the Canadian Bank of Commerce:—iron book stacks and grill floors, Dominion Ornamental Iron Company, 225 Fifth Street W.; plastering, J. B. Smith, c/o general contractor; kalamein doors, British Columbia Veiling & Roofing Company, 523 7th Street W.; roofing and galvanized iron, New Idea Sheet Metal Works, c/o general contractor; cut stone, Keith & Allan, c/o general contractor; rubble work, Victor Bianco, 509 Sixth Street E.; water-proofing, Campbell & Grill, 331 Harris Street.

Westmount, Que.

The general contract for the erection of a garage for William Clark, 622 Sydenham Avenue, has been awarded to the White Construction & Realty, Ltd., 121 Bishop Street. Approximate cost, $4,000.

Windsor, Ont.

The contract for alterations to premises on Ouellette Street for Walter Bartlet, Davis Building, has been let to Wells & Gray, Royal Bank Building. Estimated cost, $3,000.

Residences

Dundas, Ont.

D. D. Craig has started work on the erection of a residence on Melville St. Brick construction, shingle roofing. Approximate cost, $3,000.

Kingsville, Ont.

The erection of a residence is being considered by Oxley Bros. Approximate cost, $3,000.

London, Ont.

R. J. Kelly, Beattie Avenue, has commenced the erection of a residence and stables, estimated to cost $3,000. Frame and white brick veneer construction, concrete foundation, shingle roofing.

Loretteville, Ont.

E. F. Joncas, Loretteville, intends to rebuild his summer residence, at an approximate cost of $3,000. Frame construction.

Montreal, Que.

J. Deslongchamps, 1982 Boyer Street, is building six flats by day labor, at an estimated cost of $4,000. Brick construction, felt and gravel roofing.

W. A. Hayman, 35 Royal Street, has commenced the erection of a residence on Melrose Street. Nearly all sub-contracts have been arranged for.

A. Cloutier, 810 Durocher Street, has commenced the erection of a residence on Mayfair Street and of another on Oxford Street, estimated to cost $3,000 each. Brick construction, felt and gravel roofing.

Joseph Chevalier, 161 St. Jerome St., is building five flats on Parthenais St., estimated to cost $4,000. No sub-contracts will be let.

Work has been started by E. Desnoyers, 1300 Cartier Street, on the erection of three flats, estimated to cost $3,200. Brick veneer construction, felt and gravel roofing.

N. Charron, 794 Mentana Street, has commenced the erection of a residence. Owner will sub-let a number of trades.

Work on the erection of six flats on Gouin Boulevard has been started by John Boisvert, 6355 Bois de Boulogne. Approximate cost, $6,000.

Ottawa, Ont.

L. McDonald, 88 Fairmon Street, has commenced the erection of a residence, estimated to cost $4,800. Brick veneer construction, stone foundation, shingle roofing.

Work has been started by Robert Sibbitt, Bank and Albert Streets, on the erection of two residences on Frank St. Brick veneer construction, stone foundation, shingle roofing. Estimated cost, $3,800 each.

Plans have been prepared for a residence to be built on Drummond Street by John McMichael, 100 Isabella Street. Double brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,000.

Charles Wyman, 249 Creighton Street, has prepared plans of a residence estimated to cost $4,000. Brick veneer construction, concrete foundation, shingle roofing.

A. L. McDonald, 88 Fairmont Street, is considering the erection of a residence at an approximate cost of $3,000. Brick veneer construction, concrete foundation, shingle roofing.

Plans have been prepared for a residence to be built on Murray Street for A. Levinson, 96 Blackburn Avenue. Double brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

W. H. Lee, Billings Bridge, is considering the erection of a residence on Brighton Street. Stucco and brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $3,900.

An apartment house is being built on Cooper Street for E. B. Butterworth, 197 Sparks Street, by day labor under supervision of C. H. Stata, 209 Pretoria Ave. Approximate cost, $5,000.

Quebec, Que.

J. E. Boivin, 31 Sixth Avenue, Limollou, is receiving prices on all material required in the residence which he is building for E. Couturier, St. Valier St.

Ulric Trudel, 480 St. Francois Street, has commenced the erection of a residence on Lafrance Street. Brick construction, metal roofing. Approximate cost, $11,000.

Work has been started by P. Savard, 101 Cartier Avenue, on the erection of a residence, estimated to cost $6,000. Brick and frame construction, concrete foundation, felt and gravel roofing.

F. Guilmette, 180 Ste. Therese Street, is receiving quotations on all material required for the residence which he is building on St. Raphael Street for J. Roy, St. Anselme, County Dorchester. Work by day labor. Approximate cost, $7,000.

St. Laurent, Que.

E. Dufresne, Florence Street, has had plans prepared for a garage, estimated to cost $5,000. Brick construction, concrete foundation, felt and gravel roofing.

Summerlea, Que.

Tenders are being received for the erection of two residences on Waters Edge Avenue and one on Neptune Street for the Marcil Trust Company, 180 St. James Street, Montreal. Brick encased construction, concrete foundation. Approximate total cost, $9,000. Architect, J. O. Harris, c/o the Company.

Toronto, Ont.

J. L. Bartlam & Son, 62 Auburn Street, have commenced the erection of a residence, and will let smaller trades. Brick construction, stone foundation, shingle roofing. $3,000.

Work has been started on the erection of a residence by F. Knibb, 29 Ferndale Avenue. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $3,200.

Tenders on plumbing, heating and plastering required in the erection of a pair of residences on Nairn Avenue are being received by T. Teasdale, 63 Peterboro Avenue. Estimated cost, $4,400.

(Continued on page 49)

Tenders and For Sale Department

TENDERS

For the Construction of Mount Pleasant Road Bridge

Over the G. T. R. Belt Line Tracks

Separate tenders will be received through registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to noon on **Tuesday, November 2nd, 1915**, as follows:—

(a) For the complete construction of a reinforced concrete bridge.

(b) For the complete erection of a combined steel and concrete bridge.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications and forms of tender may be obtained upon application at Room No. 311, Department of Works, City Hall, on payment of ten dollars ($10.00), this sum to be refunded upon return of plans.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties as set out in specifications and forms of tender.

The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

43

Sealed tenders addressed to the undersigned, and endorsed "Tender for Fittings, Customs Examining Warehouse, Etc., Port Arthur, Ont.," will be received at this office until 4 p.m., on **Friday, October 29, 1915**, for the installation of said fittings, Port Arthur, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department, at the offices of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. Wm. Hood, Architect, Port Arthur, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, October 13, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—85830. 43

Tenders for VALVES, ETC.

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clock noon on **Tuesday, November 9th, 1915**, for the supply and erection of

Valves, Steam Piping, Special Steel Castings and Lagging, for Main Pumping Station

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall.

Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

43

Sealed tenders addressed to the undersigned, and endorsed "Tender for Steel Gates for Regulating Dam, French River, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 10, 1915**, for the construction of Steel Gates, Towers and Operating Machinery for the Regulating Dam, Big Chaudiere Falls, French River, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,
R. C. Desrochers,
Secretary.

Department of Public Works,
Ottawa, October 19, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—84783. 43-44

DRUMMONDVILLE, QUE.

Capitalists Builders

To accommodate large increase in local population (200) two hundred dwelling houses are immediately required. Splendid investment, rents running from $20 to $30 per month. To induce immediate building, plans and specifications for houses will be furnished free on application to

W. A. MOISAN,
Town Clerk.

43-45

TENDERS WANTED

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, October 29, 1915

for

Reinforced Concrete Retaining Wall, Roden School.

Iron Fence, Huron Street School.

Iron Fence, Earlscourt School.

Ash Hoist, Orde Street School.

Sale of Old Houses, Sydenham Street.

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Sureties for all tenders exceeding four thousand dollars must be furnished by surety companies. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

W. C. WILKINSON,
Secretary-Treasurer.
MILES VOKES,
Chairman of Committee.

43

Engineer desires to represent manufacturers, Montreal and district, on commission. Box 378, Contract Record, Montreal. 41-43

Mr. H. N. Munro, in a paper read before the Junior Institution of Engineers, of Great Britain, said the commercial possibilities of aluminium became evident in 1887, when Hall in America and Heroult in France produced the metal by electrical means. For electrical purposes aluminium was fast becoming common. Overhead transmission lines constructed in aluminium showed a great saving over equivalent copper lines, a saving of as much as 10 to 25 per cent. being effected, depending on the size and nature of the system erected.

Residences

(Continued from page 47)

Work has been started by C. A. Jones, 744 Keele Street, on the erection of a pair of residences on Gillespie Avenue. Brick construction, shingle roofing. Estimated cost, $5,000.

C. G. Clatworthy, 161 King Street W., has commenced the erection of a residence on Regal Road, estimated to cost $5,000. Tenders on all trades are being received. Brick construction.

Work has been started by A. Morton, 227 Pacific Avenue, on the erection of a pair of residences on Garden Avenue. Smaller trades will be let. Brick construction. Approximate cost, $3,600.

R. B. Burkell, 186 Rusholme Road, has commenced the erection of a pair of residences at 849-851 Bloor Street W. Smaller trades will be sub-let. Estimated cost, $8,000.

The Board of Control will receive tenders until November 9th for the installation of sanitary conveniences at a number of houses. Plans, etc., at office of the Medical Officer of Health.

R. E. Oliphant, 117 Willow Avenue, has commenced the erection of a residence and garage at Munro Park, estimated to cost $3,000. Smaller trades will be let. Brick construction.

CONTRACTS AWARDED

Britannia, Ont.

In connection with the alterations to a residence being carried out by H. Tuer, 49 Strathcona Avenue, Ottawa, the contract for heating has been let to the Pease Foundry Company, 287 Lyon St.

Charlottetown, P. E. I.

The contract for plumbing in connection with the residence now being built by W. M. Rowe, Box 363, Charlottetown, has been let to Currie & Murnaghan, Queen Street, and the electrical work to Charlottetown Light & Power Company.

The general contract for the erection of a frame residence for George Snelgrove, 228 Hillsboro Street, has been let to H. & S. Lowe, 238 Hillsboro Street. Approximate cost, $3,000.

Dartmouth, N. S.

The contract for heating at the residence erected for W. C. Bishop, Portland Street, has been awarded to J. J. O'Tool, 29 Ochterloney Street, and the interior fittings to the general contractors, Halifax Building Company, 23 Vernon Street.

Halifax, N.S.

Work has been started on the erection of a number of flats on Robie Street for W. G. Kennedy, Marlborough Woods. The general, carpentry, steel, roofing and plastering contracts have been let to the City Building & Land Company, 164 Hollis Street. Frame construction, concrete foundation, shingle roofing. Approximate cost, $6,500.

Hamilton, Ont.

In connection with the residence being built at 84 Eastborne Street by Lewis & Midyley, 25 Lottridge Street, the contract for steel work has been let to Hamilton Steel Construction Company, Lottridge Street. Masonry and carpentry by day labor. Brick construction, stone foundation, shingle roofing. Estimated cost, $3,500.

The following contracts have been let in connection with the residence being built by J. M. Farewell, 167½ King St. E.:—plastering, J. Wallace, Stoney Creek, Ont.; painting, H. Smith, 36 Sherman Avenue N.; heating and plumbing, Coffee & Company, 11 East Avenue N.; electrical work, F. S. Jarrett, 304 Wilson Street.

Montreal, Que.

The contract for brickwork in connection with the residence in course of erection on Durocher Street for Victor Guertin, 31 Sherbrooke Street W., has been let to E. Daoust, 52 St. Dominique Street.

I. Allard, 1360 Des Erables Street, is building a residence for A. Allard, 445 Sixth Avenue. Tenders are being received for roofing, plastering, painting, heating, plumbing and elecrical work. Estimated cost, $5,000.

Niagara Falls, Ont.

In connection with the residence being built by H. G. Scott, Victoria Ave., the contract for heating and plumbing has been let to Cole & McMurray, Park Street, and the electrical work to the Carter Electric Company, Erie Avenue.

Ottawa, Ont.

A. E. Thoms, 125½ Bank Street, is building a residence for H. Puddicombe, 410 Queen Street. Estimated cost, $4,500.

In connection with the residence built on Ossington Street for Joseph Mighan, 26 Westmount Avenue, the contract for heating and plumbing has been awarded to Thomas Watters, 288 Booth Street, and for electrical work to H. H. Saunders, 491 Metcalfe Street. Approximate cost, $4,800.

The following contracts have been let in connection with the residence being built on Melrose Street by E. Bellanger, 26 St. Francis Street:—brickwork, T. Dean, 21 Stirling Street; plastering, H. Lethbridge, First Avenue; heating and plumbing, L. Gendron, 101 Bridge St., Hull, Que. Owner will do carpentry and painting.

The contract for electrical work at the residence built on Marlboro Street for Barrett Bros., 260 St. Catherine Street, has been awarded to C. C. Gould, 219 Florence Street.

Work has been started on the erection of a residence for W. J. Spratt, 157 Sunnyside Avenue. The contract for concrete work has been awarded to W. Smith, Westboro, and for carpentry to W. Fryer, 5 Glen Avenue.

The general contract for the erection of a residence on Centre Street for Mrs. M. Graham has been let to D. A. Howard, 175 Strathcona Avenue. Stucco and brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,700.

The general contract for the erection of a residence on Bellwood Street for R. B. Yorkston has been awarded to James Cumming, 66 Third Avenue. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,000.

Pointe Claire, Que.

The contract for plastering at the residence erected for G. H. Napier, 20 St. Nicholas Street, Montreal, has been awarded to F. A. Sims, 358 Madison Avenue, Montreal, and the heating to Westmount Plumbing & Heating Company, 4278 St. Catherine Street, Westmount.

Quebec, Que.

In connection with the residence in course of erection for J. N. Rondeau, 6 Lachevrotiere Street, contracts for roofing, heating, plumbing and electrical work have been let to J. Menard, 50 St. Patrice Street.

The contract for roofing, heating, plumbing and electrical work at the residence being built on Maple Avenue for L. F. Burroughs, 147 Maple Avenue, has been awarded to J. Lafrance, 21 Plessis Street.

Ferland & Frere, 410 St. Francois St., have commenced the erection of a residence on Eighth Street, Limoilou, for Louis Ferland. Frame and brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $3,000.

In connection with the residence being built on Charlesbourg Street by Alfred Letarte, 386 Richardson Street, the contract for roofing, plumbing and electrical work has been awarded to A. Noreau, Fifth Avenue, Domaine Lairet, Que. Plastering and painting not yet let.

The contract for heating and plumbing at the residence being built by J. A. Mercier, 44 De Varennes Street, has been let to U. Gauvin, 116 Fourth St., Limoilou.

G. Moreau, 95 Fifth Street, Limoilou, has let the contract for roofing at the residences which he is erecting to V. Gauvin, 116 Fourth Street, Limoilou, and electrical work to Goulet & Belanger, St. Joseph Boulevard. Owner will do masonry and carpentry.

In connection with the residence being built by East & Masson, 62 St. Nazaire Street, for J. E. Rouillard, 30 Maisonneuve Avenue, the contract for masonry and plastering has been let to P. Tardif, 260 Napoleon Street. General contractors will do carpentry and heating, plumbing and electrical work will be installed by owner. Painting not let.

The contract for masonry in connection with the residence being built on Canardiere Road by W. Vailloncourt, 116 Canardiere Road, has been let to J. B. Verret & Son, Third Avenue, Limoilou, and for plumbing to Jules Vaillancourt, 201 Fleurie Street. Roofing and plastering not yet awarded.

Toronto, Ont.

The contract for masonry and carpentry required in the erection of a pair of residences for W. Chapman, 160 Cumberland Street, has been awarded to the Baker Construction Company, 20 Richards Avenue. Estimated cost, $4,000.

Work has been started by McDougall Bros., 566 St. Clarens Avenue, on the erection of a residence at 1350 Lansdowne Avenue for L. L. Miller, 320 Symington Avenue. Smaller trades will be sub-let. Brick construction, shingle roofing. Approximate cost, $3,500.

Work has been started on the erection of a residence at 771 Keele Street for J. Bell, 185 Humberside Avenue. The masonry has been let to Turner Bros., 14 Gillespie Avenue. Other trades will be let. Brick construction, shingle roofing. Estimated cost, $3,000.

Truro, N. S.

A frame residence is being erected for Dr. C. A. McArthur. The general, masonry, carpentry, roofing and plastering contracts have been let to W. K. Murray, Truro, and the heating and plumbing to F. Dexter, Truro.

Whitby, Ont.
Work has been started on the erection of two residences for A. Bandel. The general and carpentry contracts have been let to Threadgold Bros., and masonry and plastering to R. J. Underwood. Brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

Power Plants, Electricity and Telephones

Biddulph Township, Ont.
The Township Council are considering the installation of light and power systems. Clerk, W. D. Stanley, Granton, Ont.

Doon, Ont.
The Preston Hydro Company, Preston, Ont., are about to install a hydro electric lighting system at this place.

Humberstone, Ont.
The Village Council are considering the installation of a lighting system. Clerk, J. J. Wichman.

Kincardine, Ont.
The Town Council are considering the purchase of two transformers. Clerk, J. H. Scougall.

London, Ont.
Beattie Bros., York Street, are considering the installation of electric motors for operating their machinery.

The Globe Casket Company, Dundas Street, are considering the installation of electric motors for operating their woodworking machinery.

Niagara Falls, Ont.
The Hown Council will submit a bylaw on November 3rd, providing for a debenture issue of $14,000 for the purchase of machinery and equipment for the town's electric station. Clerk, W. J. Seymour.

Smith's Falls, Ont.
The Rideau Power Company are considering the installation of two additional units to complete their hydro power development. Managing Director, M. G. Henniger, 12 Mary Street.

St. John's Que.
Tenders will be called shortly for the installation of a lighting system on the Richilieu Bridge between the Municipalities of Iberville and St. John's.

Toronto, Ont.
The Toronto Hydro Electric Commissioners, 226 Yonge Street, will receive tenders until November 16th, for the supply of lead covered cable. Specifications at office of the Purchasing agent, 15 Wilton Avenue.

The Great North West Telegraph Company, 68 King Street E., Toronto, are considering the construction of two additional lines between Vancouver and Montreal, at an approximate cost of $300,000. About 6,000 miles of copper wire would be required.

Warwick, Que.
The Town Council are considering the installation of a light and power system, and are negotiating with the Arthabasca Water & Power Company.

Weston, Ont.
Work will be started at once on the extension of the Hydro line to Thistletown, under supervision of Allen Pierson, Weston.

CONTRACTS AWARDED

Beverley, Sask.
J. Armodt, Swift Current, Sask., has been awarded the contract for the construction of a telephone system for the West Beverley Rural Telephone Company. Approximate cost, $3,000.

Niagara Falls, Ont.
The City Council have let the contract for alterations to the lighting system to the Northern Electric Company, Simcoe Street, Toronto. Approximate cost, $4,000.

Miscellaneous

French River, Ont.
Tenders will be received until 4 p.m., November 10th, by R. C. Desrochers, Department of Public Works, Ottawa, for the construction of steel gates, towers and operating machinery for the regulating dam, Big Chaudiere Falls. Plans and specifications at offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal, and at the Depart ment. Specifications only at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Montreal, Que.
A report has been submitted to the Board of Control, recommending the construction of an incinerator with a capacity of 500 tons a day. Secretary, L. N. Senecal. Approximate cost, $200,000.

Tillsonburg, Ont.
T. C. Waller & Sons, carriage manufacturers, Broadway, Tillsonburg, are considering the installation of a lathe, drill press and electrical apparatus for charging storage cells in the garage now being built for them.

Toronto, Ont.
The Globe Land Company, 69 Victoria Street, are receiving tenders on the removal of a large barn and brick house on the Mullholland Farm, North Bathurst Street.

Assessment Commissioner J. C. Foreman is receiving tenders for the removal of the houses at 56-62 Briar Hill Avenue, North Toronto.

Tenders on the supply of cedar poles will be received until November 2nd by the Toronto Hydro Electric Commissioners, 226 Yonge Street. Specifications at office of the Purchasing Agent, 15 Wilton Avenue.

CONTRACTS AWARDED

Hamilton, Ont.
The contract for heating and plumbing at a building on Hughson Street has been let by the City Council to Staunton & Mitchell, York Street.

Late News Items

Dryden, Ont.
J. B. Beveridge is receiving tenders on the construction of an automatic telephone system for the Town Council. Approximate cost, $6,000. Town Clerk, I. J. Wilde.

Gosfield, Ont.
The Township Clerk, W. H. Noble, Cottam, Ont., will receive tenders until October 30th for the construction of several drains. Estimated cost, $4,000.

Midland, Ont.
Fire has destroyed about 100 feet of dock owned by James Playfair & Company, as well as large quantities of coal and lumber. Total loss about $325,000.

Montreal, Que.
In connection with the stores and flats being built at St. Antoine and Atwater Streets for W. Skead, 728 Bloomfield Avenue, Outremont, the contract for roofing has been let to J. Dunphy, 55 Barrie Street, plastering to Z. Bouchard, 12 Bourget Street, painting to Martin & Montgomery, 556 Madison Avenue, and electrical work to W. Porteous, 1009 Dorchester Street West.

Tenders on the erection of a comfort station in Lafontaine Park will be received until November 2nd by the Board of Commissioners. Plans and specifications at office of the Architect, A. Chausse, City Hall.

Saskatoon, Sask.
Tenders will be received until 4 p.m., November 12th., by R. C. Desrochers, Department of Public Works, Ottawa, for the installation of fittings at the Post Office, Fourth Avenue and 23rd Street. Plans and specifications with the Caretaker, Public Building, Saskatoon, with W. T. Mollard, Clerk of Works, Regina, at the Post Office, Brandon, Man., and at the Department. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto, Ont.

St. Catharines, Ont.
The following contracts have been let in connection with the business block in course of erection for J. Balsam, James Street:—carpentry, Davis Bros.; cut stone, F. Hoare, 222 St. Paul Street; steel work, Hamilton Bridge Works Company, Limited, Bay Street N., Hamilton.

Toronto, Ont.
Grimshaw Bros., 24 Brookmount Rd., are receiving tenders on interior trimming required at the stores and apartments in course of erection at 1830 Queen Street E.

Valleyfield, Que.
The Town Council have let the contract for the construction of an intake pipe to O. Cossette, 101 Larocque Road. Contractor will furnish material.

Windsor, Ont.
The contract for paving Marion Street has been awarded by the City Council to the Chick Contracting Company, McDougall Avenue, Windsor. Work has been started. Approximate cost, $5,500.

Yarmouth, N.S.
Tenders will be received until 4 p.m., November 9th, by R. C. Desrochers, Department of Public Works, Ottawa, for the installation of interior fittings at the Post Office. Plans and specifications with the Caretaker, Public Building, Yarmouth, W. Bishop, Clerk of Works, Dominion Buildings, Halifax, and at the Department. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

ESTABLISHED 1886

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and Engineering Review

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By W. J. Haire

"Non-Combatants" in Municipal Circles

IN a day when the municipal engineer has to be thankful for small mercies it is gratifying in a measure to find that a Board of Works' recommendation looking to the dismissal of an Ontario City Engineer was thrown out last week by the City Council on the ground that the charges upon which it was based had not been proved. The case is noteworthy in view of the recent discussion in this journal anent Mr. J. W. B. Blackman's scheme of an insurance of office tenure.

The experience of the city engineer in question stands out as being a "fortunate" one for the official, for only too often the least adverse criticism, much less a definite recommendation, sweeps the engineer off his feet and out of office before he has time to prepare his defence.

It is a peculiarity of the enlightened administrators in these small cities of old Ontario that they can never find a City Engineer "big enough for the job." So disproportioned is their idea of their own capabilities, and to such an enviable height do they persuade themselves that the city can be raised by the enterprise of practical men like themselves, that the trained engineer—that annoying person who confounds them with his technical knowledge—appears about as big as though he were viewed from the wrong end of a telescope.

In the Ontario city that we are speaking about the Board of Works found themselves at loggerheads with the engineer, and recommended his dismissal. Their recommendation was full of generalities. So vague were the charges that even a member of the City Council said that that body would be guilty of a breach of British fair play if it supported the recommendation. This gentleman pointed out that the City Engineer was a hard-worked official, inadequately staffed, and employed at a clerk's salary, that much creditable municipal improvement could be placed to his credit, and that honour should be given where honour was due. As a result of this eloquence, and other pleas of like touching appeal, the under-staffed, overworked, underpaid City Engineer was allowed to retain his job.

In drawing attention to this case we can make our point briefly. In common parlance, the Town and City Engineer throughout Canada "has to take too much dirt." So long as this continues so long shall we find little bits of shopkeepers and other nonentities on governing bodies eager and anxious to assist in dragging him in the mire. Whatever a man's calling, he must have independence to command respect. This the municipal engineer, under present conditions, has not got: he is supported by no professional body; he is afforded no Government protection against incompetents. His case is even more desperate than President Wilson's, for he cannot even suggest that an explanation of outrage would be in order.

Beyond the outer walls of the city we have mentioned there is a penitentiary. Possibly the influence of this institution is accountable for the rough sense of British fair play that caused the difference to arise between the City Council and the Board of Works. However this may be, the situation is lamentable enough, in all truth. Only the immediate resignation of the engineer could have preserved the dignity of the profession, for when a house is divided against itself the structure may be said to be unsafe.

If municipal engineering jobs at clerks' salaries are at such a premium throughout Canada that those who get them have perforce to reconcile themselves to continual abuse and opposition, the outlook in this branch of work is poor indeed. Whatever may account for a man's inability to fight—whether it be pride, humility, salary (or lack of it), for family reasons, or because of his health—he is a poor creature when he can't.

Expert Juggling

INVESTIGATION into the construction of the Law Courts and Central Power Station at Winnipeg reveals the fact that seven tenders for the Law Courts were received on June 12, 1912. The three lowest were the National Construction Company at $763,974, Thomas Kelly & Sons at $887,500, and C. H. Simpson & Company at $890,107.

The National Construction Company, of which C. H. Simpson was president, were offered the contract but they refused to sign, stating there had been an error in their tender.

The Kelly firm were then offered the contract, but they replied that they had just received a large cut-stone job and could not undertake another contract involving a large quantity of cut stone.

C. H. Simpson & Company then signed a contract with the Manitoba Government at $890,107. On Aug. 14 they sub-let the entire work by contract to the National Construction Company at $854,107.

The National Construction Company later gave Thomas Kelly & Sons a sub-contract for stone work in the building.

We knew that contractors numbered in their ranks a select few skilled in the art of prestidigitation, but we take off our hats to expert jugglery of this kind.

Canada's Remarkable Financial Condition

ONE of the most important public addresses that have been delivered by public men in Canada since the outbreak of the war was that of Hon. W. T. White, Canadian Minister of Finance, in an address delivered before the Board of Trade of Toronto on October 7th. Realizing that he was addressing a representative body of Canadian financial, commercial and industrial men, Hon. Mr. White confined his remarks definitely to Canada's financial and industrial situation. Preceding the outbreak of the war, he said, Canada had been a borrowing community. During the six months immediately preceding the war we had borrowed in international money markets over $200,000,000; or more than $1,000,000 a day. For two years previous to the war—we realized this now—the war had been casting its shadow upon our affairs. Its effect had been felt in international money markets as long ago as 1913. From that date interest rates had stiffened, and, at the same time, in the international money markets, a great many short term obligations were outstanding. Canadian borrowings were being used in the construction of works and in building operations throughout the country. They represented the proceeds of loans, secured by Dominion, Provincial and Municipal Governments, railways and other corporations, and their proceeds for the most part found their way into fixed capital. In Canada at that time we had a very heavy so-called adverse balance of trade. This meant that Canada was importing more than she was exporting. One naturally asked how we were paying this adverse balance. We paid it by borrowing more money. So, there was not only an adverse balance of trade to be considered, but there was also the interest on some $140,000,000 which Canada owed to the other nations of the world, representing the interest upon money borrowed in the past. Canada had to provide not only for the balance, but for the interest payments. Our borrowings abroad, in London, and in the United States, approximated roughly the sum total of our adverse balance of trade and our interest obligations.

At the outbreak of the war some very serious problems confronted Canada. In the first place there was the question of panic which usually succeeds the declaration of war. In the second place there was the question of the conserving of our gold reserves. In the third place there was the dislocation of trade. In the fourth place there was the question arising out of the maturing of short date obligations in the London market. In the fifth place there was the paramount question of Canada coming manfully forward and doing her full share in the great struggle, of supplying men and raising money for prosecuting the war until it should be brought to a successful issue. That last problem was the greatest consideration of all. War was the first business in this country. All these problems were very serious ones for a government and for a people, and he proposed to tell how they had been met.

Problems Produced by the War

The first question, that of panic, necessitated immediate action. Measures were taken at once to encourage confidence. There had not been a sign of panic in Canada since that time. The credit of the people of Canada as a nation was involved in connection with the short date maturities in London. Millions of these were maturing last fall when the London stock exchange and the bourses of the world were closed and the British Government was taking the market to itself. The banks of Canada, with the assistance of the Government, took care of all these maturing obligations in London, and Canada's credit came through unscathed.

Then there was the question of our gold reserves. The Government passed an order prohibiting payment in gold in Canada. That was effectual so far as the local situation was concerned. It would not have been effectual in the international situation. We could pay in domestic currency in Canada, but international obligations must be settled in gold or the equivalent of gold in exchange. Canada's imports were then much greater than her exports and we had an indebtedness to meet of about $140,000,000 a year. The result would have been, if certain things had not happened, that Canada would have been stripped of her gold. In 1913 Canada's excess of imports over exports was $300,000,000. In 1914 it had been reduced to $180,000,000. In 1915 it had been reduced to $33,000,000. Many factors had entered into this situation. In the first place the people of Canada began to economize immediately after the war. When people begin to economize they use less and consequently have more to sell. Then the "Made in Canada" movement was started. That movement meant that the people desired to make for themselves those things which they had formerly brought from abroad. The result of the action of the people in economizing and manufacturing those things for themselves which they could manufacture, and above all in increasing their production, was that, instead of an adverse balance of trade against Canada to-day, in one brief year we had entirely reversed our position; so that, for the five months ending August 31st, 1915, we had a favourable balance of trade to the extent of $36,000,000.

Another factor that had a great influence in the situation was the expenditure on the part of the Government for raising, equipping and maintaining our troops in Canada before they were sent forward; also the orders given by the British and Allied Governments for materials, for equipment, and for shells and munitions of war.

The next question before the Government had been that of the gold reserves. The Government passed an order prohibiting payment in gold. By reason of the change in the trade balance it had not been necessary for gold to flow out of Canada for the payment of international obligations, and the result was that Canada's gold reserves had been maintained from the very outbreak of the war until the present day. The Canadian dollar had never depreciated in value. It was worth 100 cents in gold to-day. Internationally speaking, notwithstanding the war, this country had grown richer. If the war continued, and we kept increasing our production by one, two or three hundred million dollars a year, and increased our favourable balance of trade by hundreds of millions of dollars it would be obvious to all of us that we must grow richer notwithstanding the war. In a war such as this not only would men and munitions count, but money as well. If the people of Canada would increase their production and exercise, not parsimony, but reasonable thrift and economy, this country would easily be able to sustain the burden of the war, and to do its full and manful share, and even much more, in carrying it on. Canada's strength lay in her vast natural resources, and it seemed to him that, with our soldier boys going to the front and offering their lives, it was the duty of those who remained at home to increase to the utmost their exertions to produce, and to save, in order that they might contribute to the national strength, and thus help to bear the burden of the war.

How Dislocation of Trade Was Handled

At the outbreak of the war we had been confronted with the question of a serious dislocation of business. There had been a period of severe dislocation. It became necessary to do all that could be done to promote trade and to minimize unemployment. From all parts of Canada the Government naturally received requests which it was difficult to deny, for the carrying on of a very large programme of works and undertakings, with the idea of furnishing employment. When the war broke out it would have been disastrous for the Dominion Government to close down public works and add to the unemployment. Many employers of labour kept their factories going, at a loss in some cases, so as to furnish employment for their men. But that situation had been gradually changing for the better. The economic outlook for Canada to-day, in his opinion, was excellent. Our large expenditures in Canada for war; the large expenditures of Great Britain and the Allies for supplies; the large orders for shells and munitions of war; the greatest crop by far in the history of Canada; all these had materially modified and changed our situation. The credit of the Dominion of Canada was vital for the present and for the future. It must be preserved at all hazards. Therefore, he thought that the true policy for to-day was, that since these other expenditures had taken the place of the large Government expenditures on public undertakings, the Government during the period of the war must have regard to its credit and must go on only with necessary work. After the war had come to an end there would be a period—a brief period, he believed, in the case of Canada—of dislocation and readjustment. He believed it would be brief in Canada because our natural resources were so great and because we would continue to increase our production.

The slogan for all time in Canada was to produce as much as this wonderful land could be made to produce with the men and the capital that we had. After the war, he believed the policy of the Government should be to press forward with useful public works, having preserved its credit in the best possible condition for accomplishing that end.

Hon. Mr. White then devoted his attention to the Government's financing of the war. War was the first business of the Government to-day. There could be no question as to prudent financing in connection with carrying on the war. Our expenditures should be measured by our efforts and our efforts should be the greatest of which the Dominion of Canada was capable. When he had spoken of the necessity for limiting our expenditures, he had referred only to civil expenditures, not to war expenditures. In view of the necessity for great war expenditures the Government had been confronted with the problem of preventing gold exports. They had accomplished this by borrowing ahead. If the Dominion had borrowed in Canada the money for war expenditure, the result would have been the export of Canadian gold. Therefore the policy adopted had been to borrow money outside of Canada. This redressed the adverse balance of trade and avoided gold exports. Arrangements were made with the British Treasury under which it loaned money to Canada—at the same rate as it borrowed on its own account—money for the expenditure that Canada would require for carrying on the war. These borrowings and our borrowings in New York had prevented gold exports from Canada.

During the past five months Canada had secured a favourable balance of trade of $36,000,000. Suppose this continued, what would be the result We would have money to invest. In other words, the time was now come when Canada would be able to finance her own war expenditures.

A Canadian War Loan

"After this crop movement is over," Hon. Mr. White said, "We shall consider the question of a domestic, national, patriotic war loan in Canada; money to be spent in Canada for the equipment and the maintaining of Canada's troops, which we shall continue to send forward in ever increasing numbers. Statements in the press, that a loan of $150,000,000 will be put on, have no foundation in truth. There will be no necessity for putting on a loan of $150,000,000 at any one time. Whatever will be done will be done at the right time, having regard to the conditions prevailing in Canada, and for such moderate amounts as the situation may warrant. At the present time I am happy to say that at no time during my term of office, or, I believe, during Canada's history, has Canada's ready cash situation been better than it is at this moment."

After the strain of the crop movement, Hon. Mr. White believed, the people of Canada would respond to an invitation to subscribe patriotically towards a domestic Canadian war loan and they would be given the opportunity on terms that would be equitable and fair to every one in Canada.

By the way—

"To my mind there is something absolutely revolting in the idea of anybody making profits out of the nation's agony." These words of the Chairman of the Steel Company of Scotland are quoted by The Ottawa Citizen in an article dealing with war profits in Canada, and particularly with the operations carried on under the direction of the Dominion Shell Committee. What of these charges, if true? Singular that there should have been discussion over the propriety of singing "O Lord, our God, arise, Scatter our enemies!"

* * *

> In Rama was there a voice heard, lamentation, and weeping, and great mourning, Rachael weeping for her children, and would not be comforted, because they are not.—Matthew, 2, 18.

We might substitute the word Canada for Rama, and the names of countless British mothers for Rachael, and find herein a verse aptly descriptive of one side of the war. A verse descriptive of the other side has never been penned. To find words applicable to those who are sucking the Empire's life-blood in the mishandling and abuse of war contracts would tax the ingenuity of Satan or his friend the Kaiser.

* * *

Ford says Canadians **must** buy his cars. Dear reader, if you have the price, buy some other car—or walk.

* * *

Does the western farmer really want free wheat, or is it Jim Hill that is behind the agitation? Where did the money come from that financed more than one deputation to Ottawa? The other day a friend of mine asked one of the delegates who paid his expenses. The reply was that he did not know or care, that he was paid so much a day and expenses. The western farmer is better without free wheat if he only knew it.

* * *

Jim Hill, as we all know, is a Canadian—I mean Canadian-born. Some ten years ago when thousands of U. S. farmers were leaving the several States through which Jim Hill's lines run, for the Canadian prairies, in an address to the St. Paul Chamber of Commerce, he made the statement that the Canadian West would never grow wheat; that it was but a frozen waste, fit only for convicts and fur-bearing animals. But the United Statesers knew better, and the movement north continued in increasing numbers. About this time Jim Hill changed his tactics and began to build branch lines to the Canadian border. He now wants business for these lines.

* * *

Have you been made an Honorary Colonel yet? This does not refer to you, but let me give you a pointer—the less one deserves the title the surer he is of getting it.

* * *

Speaking of honorary colonels, there is a recent story told of a certain honorary colonel from Toronto who by some means found his way into the British lines in France, and in the uniform of a Staff Officer. Not many hours passed before he was questioned by a British officer as to his status, etc. Unable to give a satisfactory account of himself he was ordered by this officer to remove his uniform and leave the lines.

* * *

Major-General Sir Sam Hughes said in Toronto last week that he did not believe in compulsory service, but in universal training. If Sam had not been a great soldier, he might have been a great diplomat. Je ne le pense pas.

* * *

We wonder if Sam Hughes' "wind" would last him out the ninety miles from Niagara-on-the-Lake to Toronto!

* * *

President Wilson to the Kaiser—after having been kicked for the 'teenth time: "I hope, Sir, you will be able to explain this satisfactorily."

* * *

When you are next offered German goods, be it to-morrow or fifty years hence, remember the foul murder of Nurse Cavell by German officers. The uncivilized American red indian at his worst would not have been guilty of such a crime. No, dear reader, the United States made no protest!

* * *

The Australian Government has pledged itself for good against articles of German manufacture. Doubtless this will be followed by a readjustment of import duties. The while German firms are bidding on the construction of radial brick chimneys and other business in Canada (vide last issue). And there is a faction in the Toronto City Council disposed to consider a literal interpretation of "Love your enemies." May we do unto the Germans as they have done unto us—only may we do it first in future.

* * *

The astounding suggestion is made that Peary was thirty miles away from the North Pole when he reached it. See Cook smiling.

* * *

When shall we have the next instalment of that fascinating serial "Too Proud to Fight?"

* * *

It is reported that Chatham is to have a million-dollar beet sugar factory, employing upwards of three hundred men in the busy season. A timely announcement. Hard to beet, in fact.

We don't want free wheat: we want our own industries developed, etc.

* * *

Municipalities who desire an easy and inexpensive road to a reputation for good works might "donate" machine guns.

* * *

The incorporators of a newly-organized house-wrecking concern at Toronto are Aaron Stein, William Fink, Samuel Floderwasser, Solomon Eknowitz, Abraham Litovitz, David Ochekowsky, and Eiser Reitapple. If house-wrecking gave out they might try jaw-breaking.

* * *

That talk about constructional operations in winter is staged at the right moment, if any confidence can be placed in the weather prophet of Paris who has staked his reputation on the forecast that winters will be unusually cold for twenty-six years.

* * *

I read in a New York paper the other day that Frank Skinner, the New York City Consulting Engineer, had just returned from a five months' tour of London, Paris, and Le Havre, in the course of which he secured orders from the Belgian Government for several hundred portable interlocking steel houses, to be manufactured in the States, and also got a British contract for steel piles for protecting military trenches. Doesn't this sound like "Wake up, Canada!"? For goodness sake, put a business man at the head of the Department of Trade and Commerce.

* * *

It is reported from Ottawa that the Minister of Public Works, Bob Rogers, and General Sam Hughes are not on peace terms. The Honorable Robert Rogers is the type of politician this country would be well rid of.

* * *

It now looks as if Sir Robert Borden has trouble on his hands in connection with his Shell Committee. It is surprising that exception was not taken months ago to the personnel of this Committee, which is made up as follows:

Brig.-Gen. A. Bertram,
Bertram & Sons, Machinists, Dundas, Ont.
Honorary Col. T. Cantley,
Nova Scotia Steel & Iron Co.
Honorary Lt.-Col. G. W. Watts,
Canada Foundry Co., Toronto.
Brig.-Gen. T. Benson.
Lt.-Col. C. Greville Harston.
Lt.-Col. F. D. Lafferty, R. C. A.
Honorary Col. D. Carnegie, M.Inst.C.E.
Mr. E. Carnegie.
Mr. J. W. Borden.

With the exception of the first three mentioned all are employees of the Government. Imagine a meeting of this Committee accepting orders from themselves.

* * *

The Kaiser's birthday will soon be here and we anticipate the United States will again cable the Kaiser its congratulations.

"Commentator"

The War and Its Relation to Engineering Work

By R. O. Wynne-Roberts*

WHILST engineers take a prominent part in the war, both on the field and in the factory, building for and operating in the air, and under the sea, devoting their brains, their energies and their lives to the cause of their country, there still remains to them a most important function—the engineers not engaged in military duties must also do their share in maintaining the ordinary life of their nation. The people cannot abandon themselves entirely to war and its devastating operations. Millions of men will fight, but there must be many more millions required to maintain them on the battlefields of Europe; and furthermore, ordinary business of peace-time must be kept going, even if it can only be done in a perfunctory manner.

During the war, and after peace is declared, there are, or will be, new conditions created, new ideas developed and new duties and responsibilities imposed. The present war has already been productive of these changes to an extent far exceeding our anticipations

The long period of peace among the great nations has given ample opportunities for a tremendous expansion of commerce in and between all countries. This has made the nations interdependent for raw materials, commodities and service.

Few realized the close relations which existed between the various peoples of the earth until the European war was declared, and then there was consternation, financial chaos, and commercial disruption surpassing anything that the most prescient men ever prophesied. Business, for a while, was completely dislocated by the absence of international and even national confidence, factories were closed, public works suspended, and thousands of work people were thrown out of employment. Certain supplies were suddenly cut off, and as the war burst on the world like a bolt from the blue there was no time to accumulate a stock of them. The prospects were dismal.

By years of concentration on the manufacture of chemical products and other commodities, and by world-wide organization of banks, shipping and merchants, Germany and Austria had been able effectually to compete with other countries. They had secured customers everywhere, and being able by syndication, co-operation, and concentration to produce goods at a lower price than was profitable in Britain and America, those and other countries were to a great extent dependent on Germany and Austria for many things. German chemicals, electrical equipment, and glassware, for example, were virtually monopolies; consequently at the beating of the war drum and the call of the bugle these supplies ceased, and the customers were thrown on their own resources. The disturbance of business has undoubtedly been disastrous, but the lesson will bear fruit in abundance. Engineers, chemists, metallurgists, geologists and scientists of all classes were suddenly requisitioned to find a way out of the dilemma. Drugs, chemicals and appliances were needed for the army and navy. Dyes were urgently wanted for commercial use; mantles for gas lighting and countless other articles were absolutely necessary for the conduct of the war and the continuation of ordinary human activities.

The abstract science of mathematicians, the synthetic abilities of chemists, the researches of geologists, the investigations and experiments of metallurgists, the microscopic studies of bacteriologists, and the efforts of all, were called upon to evolve a way of satisfying our present-day requirements. Twelve months and more have passed by, and much has been accomplished, but the gap is not yet filled.

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*Consulting Engineer, Toronto

Raw materials which formerly were inadequately utilized now receive more attention. Gas-tar, for example, which was used as fuel in the United States, now is distilled, and the multitude of dyes, drugs, explosives, ingredients, disinfectants, preservatives, etc., are extracted. The British formerly shipped enormous quantities of tar and other by-products to Germany, where they were converted into something else and re-shipped to Britain and elsewhere, but with the aid of the Government a national co-operative industry has been started, and scientists of repute are engaged to conduct researches. Special glassware, heat testing cones, firebricks for intense heat, electric equipments, and many other things, are now being made in America and Britain, and these are stated to be even superior to the German productions, which prior to the war were considered unsurpassable. Denatured alcohol and other liquid fuels are now often used instead of gasoline. Enough has been stated to show that the war has awakened the nations, and they are calling for independence in the matter of supplies. Canada can do much in this direction. We have waste wood and timber and straws which are burned in enormous quantities. The manufacture of liquid and solid alcohol for power, paper for building, etc., cordage, sacks, etc., sugar, terra-cotta, enamelled bricks and tiles, are awaiting Canadian engineering and scientific skill. We have abundant water powers for hydro-electric schemes to manufacture nitrate from the air.

During the war engineers, who are not engaged in the production of munitions, need not twiddle their thumbs and wait patiently until the tide turns: Canada needs the full development of her resources, and it is in times of suspense like the present that much can be done.

Ordinary business for engineers is quiet even in neutral countries. In fact, the European conflict has stagnated almost every enterprise throughout the world.

After the war, when the finances of the countries have been more or less re-established, it is reasonable to assume—or, at any rate, to hope—that engineering activities will be resumed and that the arrears and losses due to the period of the war and the depression will in time be adjusted.

There will also be the stupendous work of reconstruction in the devastated countries. War has always meant destruction. War is hell, said President Grant; but no war has wrought destruction on such a gigantic scale as the present one. Scores of Belgian and Polish towns, and hundreds of villages, have been swept out of existence. French, Belgian, Serbian, Austrian and Russian communities have been scarred, scorched, and scourged by the war.

All these will need rehabilitation in some way. The task seems almost hopelessly stupendous, and we can hardly expect anything more than a gradual rebuilding of the homes, communities, and industries. But it will doubtless be unwise to reconstruct on the ruins of the old: the sites must assuredly be unhealthy, and, moreover, advantage will probably be taken of the opportunity to rebuild on some preconceived lines of town planning.

Consequently the new towns and villages may rise on new locations, and this may cause some trouble: the values of old properties will disappear, owners will suffer, old associations will be lost, and everything will be strange. Napoleon, however, effected similar changes in Paris, and Hausman transformed the city—with the result that the city benefited immensely by the enforced improvement.

Buildings will be erected, roads constructed, and sanitary works provided—in short, new towns on modern lines will rise like Sphinx of old out of the ashes of the destroyed homes.

This will create work for engineers, architects, builders, and contractors; and as the conditions will demand the adoption of expeditious and economical methods of construction, there is room to expect that Canadian and American ideas will be adopted.

Further, at the close of the war some countries will be opened to enterprise, and there will be scope for public undertakings of different kinds.

Reinforced Concrete Sewers

THE results of tests recently made upon reinforced concrete pipe for sewers by Mr. A. T. Goldbeck, Assistant Engineer of the Testing Laboratory, Bureau of Surveys, Philadelphia, are described in a paper presented to the American Concrete Institute. The author's conclusions are as follows:—

1. Reinforced concrete pipe, when properly made and properly cured, is very satisfactory for the construction of sewers.

2. The use of a concrete cradle greatly increases the stiffness of the pipe, and raises the load under which initial cracking takes place.

3. For sections of the size tested and for smaller sections, the placing of the reinforcing near the inner face throughout the entire circumference seems to be justified.

4. The matter of curing should be very carefully controlled, as much stronger pipe will result if care is taken to keep them thoroughly wet, preferably for a period of two weeks.

Finally, the manufacture of concrete pipe should be much superior to that of ordinary construction. Not only should the quality of the available material be carefully investigated, but density tests should be made in order to combine these materials in such proportions as to produce the densest possible concrete. Density and elastic strength are absolutely necessary for good concrete sewer construction.

The United States Government is considering a series of road experiments, the results of which are to be used to determine an engineering formula for vehicle taxation, based on the road destructive effect of all types of vehicles. The aim is to obtain a universal formula on which to base taxation, that a uniform tax may be established, each vehicle being levied so much per year according to the amount of damage, i.e., road wear, it causes, so that sufficient money will be available to build highways of the standard now required by the newer and faster traffic.

A wire brush provided with a suitable shank and operated by an electric drill is said to be a cheap and very effective tool for cleaning concrete and stone surfaces. It is probable that this would be an effective device for cleaning forms.

A Review of Recent Progress in Municipal Engineering Practice

By the London (Eng.) Correspondent of The Contract Record.

MUNICIPAL engineering may be said to have prematurely decreased during the first week of August of last year. Great things were expected of it, for meetings and conferences and trials galore had been projected, and numberless were the schemes whose first sod would have been turned or completion certificate signed, sealed and duly accredited ere now. But since that fated August a state of "hanging up" has prevailed. In the earlier days of the catastrophe which has overtaken the civilised world there was much talk of "business as usual" as regards public utility schemes. The country had to be kept going. There were big liabilities to meet, including (as it has turned out) a War Bill of three million pounds a day. Work must be found for all; and the local Government Board held an unprecedented number of preliminary inquiries. Then reaction set in, and schemes were abandoned in every direction. There was other work for the manhood of the nation to do, and the services of those who were unfitted for the fighting line were requisitioned in works of defence and in the manufacture and transport of munitions. Labour has, in a way, come into its own, its scarcity having placed it at a premium; and it has been recognised that the accumulated dollars of even a multi-millionaire are powerless to so much as pick up a spade or shovel—much less to wield one. Wisdom or unwisdom, this wholesale abandonment of schemes has been forced upon the Government, and public work (except that of a military nature) lies in a condition of suspended animation. The record with which one has to deal is a slim one.

Housing and Town Planning

Towards the end of last year was issued "The Report of the Committee appointed by the President of the Board of Agriculture and Fisheries to consider and advise the Board on Plans, Models, Specifications and Methods of Construction for Rural Cottages and Outbuildings." The publication was not nearly so formidable as its title, and contained much useful (and much trivial) information on cottage buildings. An experiment in furnished houses for the lower class of workers (which possesses no furniture) is to be undertaken in Manchester, a scheme having been approved by the Corporation, and it will be interesting to watch developments. Each house will have three independent living rooms, and the furniture will be mostly of the fixed type—a wise precaution. The scheme is possibly in the "hung-up" stage now. Town planning has been in evidence mostly in the way of conferences, notably those held at Cheltenham and Liverpool. At the former, a most valuable collection of town plans—from all parts of the world—was exhibited. The Government's Bill for providing three millions of money to meet to some extent the deficiency in rural housing accommodation is necessarily among the "hung-ups."

Road Board Report

The report of the Road Board, which is issued annually, is not a technical document, and the last issue (that for 1914) contains very little that would interest Canadian readers. It deals in the main with the financial and administrative phases of highway development, the amount available for loans, the purposes of grants and loans and so forth. There is, however, one paragraph which may be quoted, setting out clearly as it does the policy of the Board in assisting local authorities. Says the report: "The experience hitherto gained by the Board as to the views and requirements of highway authorities, and as to the condition and needs of roads throughout the country, has confirmed them in the opinion expressed in previous reports, that the most pressing and most universal need is the strengthening and improvement of the crusts (which include foundations as well as surface coatings) of existing roads. In a few districts important roads are so narrow that they need widening before any other improvement is attempted, and these cases are specially dealt with as applications are submitted to the Board; but the general need of most rural and inter-urban roads is that they should be made as rapidly as possible fit to carry the increasing motor traffic satisfactorily to the road user, and without undue deterioration of the road surface. This is the view almost universally expressed by the representatives of highway authorities in charge of rural and inter-urban roads. Consequently, the board have concentrated their efforts towards the improvement of road crusts, and after the important roads requiring this kind of improvement have been dealt with, they will be able to assist more freely than they have hitherto done other kinds of road improvement." Works of reconstruction were until quite recently receiving their share of the Board's attention, and were being undertaken as funds allowed; but works in widening received but scant shrift, the Board being rightly of the opinion that their more important duty is to render the roads of the country fit to carry the traffic placed upon them. So far as local authorities are concerned, the Road Board practically put their shutters up when the war assumed serious proportions, and the Government has now retorted by drawing down the blinds of the Board and annexing its carefully hoarded funds. Whether the Board will ever be resuscitated in its erstwhile form is a matter of doubt.

Road Classification and Census

Some years ago, a Mr. Walton Maughan, District Surveyor under the Warwickshire County Council, prepared an elaborate scheme of road statistics and traffic census extending over the whole of England. As the writer said, when noticing this scheme in 1911, "much has been written about the necessity for the classification and standardisation of roads and road materials, and but few people seem to have been aware that here, approaching absolute completion, are statistics and other information ready to hand." These remarks had much more pertinence when the Road Board started their scheme of classification, and it seemed a pity that the valuable information acquired by Mr. Maughan at great personal expense could not have been made use of. As it is, the traffic census (a preliminary to classification) of the Board has been abandoned, owing to the war, and what has been done will have to be done over again. Classification of some sort will be found imperative if the system of grants comes again into operation—imperative, that is, if the grants are to be distributed equitably.

Trials and Experiments

Two items falling under this head call for notice. The first is what is known as the Scottish trials. In these certain definite specifications and conditions have been prepared, and experimental road lengths laid down in a number of districts in Scotland, in situations where traffic is fairly comparable. The trial lengths in each case are eight in number, and are shortly as follows: (1) Ordinary water-bound macadam with metal as generally used in the locality—preferably whinstone. (2) The same surface tarred with distilled tar to Road Board specification. (3) Macadam, 3 in. thick, grouted with a mixture of pitch and sand. (4) Macadam, 3 in. thick, grouted with pitch alone. (5) The same surface sealed with prepared bituminous mixture. (6) Macadam superimposed upon and rolled into a layer of tarred chippings, then grouted and surface sealed with prepared bituminous mixture. (7) Tar-macadam—i.e., tarred material—surface sealed with distilled tar. (8) The same surface sealed with prepared bituminous mixture. Other forms of construction are not excluded, so long as their cost does not exceed 2/6 per square yard. As will be seen the experiments are practically confined to various forms of tar macadam and pitch grouting, but they will do nothing towards settling the controversy ranging round the use of slag, granite and limestone. Still, there is not perhaps very much in the arguments advanced for and against the use of these three materials, the binder being after all the important factor.

Reinforced Concrete Road Experiments

Much greater interest attaches to the experiments in reinforced road construction which are being carried out by Mr. H. T. Chapman, the county surveyor of Kent, but little need be said on these as reference has already been made to them in the Contract Record (January 27, 1915) and there is nothing to report to date. As was then said, it is a pity that one of the experimental lengths was not laid in plain concrete. The steel reinforcement of road foundations is making but slow progress, and no authoritative pronouncements upon it have yet been made. It is certain that, where modern heavy traffic has to be provided for, the old 6 in. foundation of plain concrete is insufficient. Two alternatives present themselves—increased thickness and reinforcement, and trials regarding the respective merits of these need undertaking.

Training of Highway Engineers

There was a touch of humour in the report of the Institution of Municipal and County Engineers to the effect that they had decided to adopt "a special examination for county and highway engineering." The press recorded it as "a matter for congratulation," quite overlooking the fact that such an examination had been held in England for years by the Institution of Municipal Engineers. The Institution of Civil Engineers issued a report on the practical training of engineers who might seek admission to their body, but as only those who have been articled to a member can gain admittance the report is practically valueless. Mr. J. A. Brodie, city surveyor of Liverpool, put the whole matter very pertinently when he said "I want a good standard of engineering education. If you give me a man who has worked in the office and on the work, and educated himself up to the same standard as he gets in the university, I will take him every time in preference to the university man." As is known, the examinations of the Institution of Civil Engineers are purely academic.

Sewage Disposal by Dilution

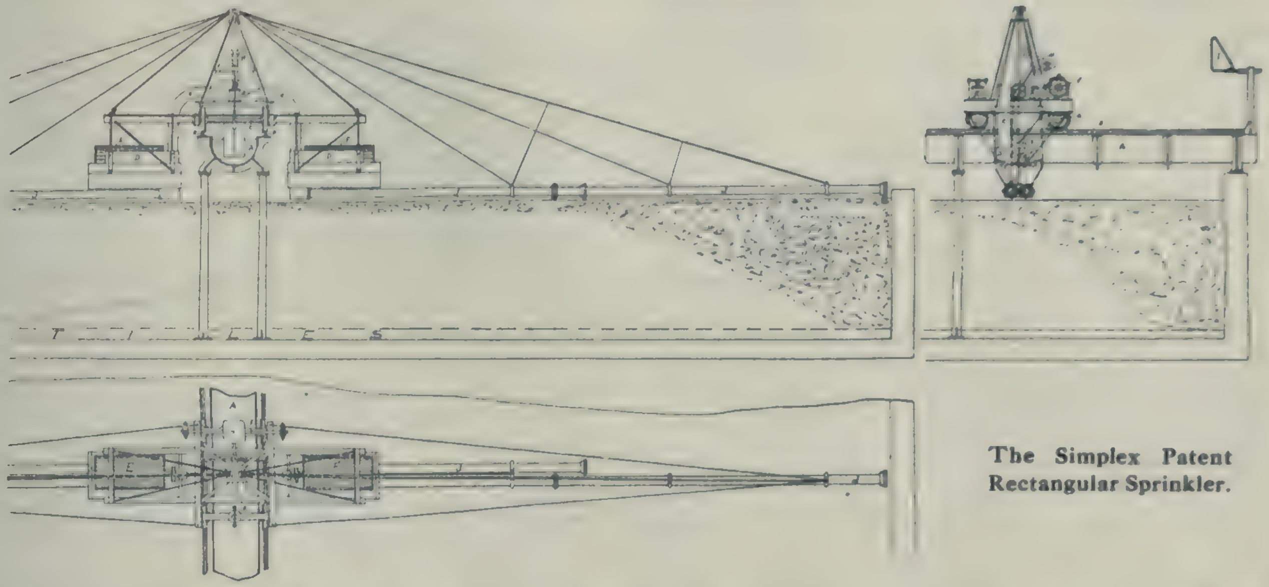
Among the important events which have marked progress in sewage disposal is the issue of the final report of the Metropolitan Sewerage Commission of New York. After the most patient and thorough investigation the Commission arrived at the opinion that the sewage of New York could be effectually treated by dilution in the waters of the harbour and bay if a certain proportion of the impurities were first removed. The solids in suspension removed, it was felt that the liquid residue could be dealt with by dilution without causing a nuisance. This utilisation of the dilution process would mean to countless districts an enormous reduction in expense, and with such a weight of authority to back it an impetus will be given to its more general adoption. Improved methods of tank treatment must necessarily follow, and much has been done recently by both manufacturers and engineers. The great objects to be served by tank treatment are maximum efficiency in the removal of solids in suspension and the discharge of a sludge effluent as free from smell and from gas—generating properties as is possible. There are several tanks now in use which have gone far in these directions.

The Oxidation of Sewage

It is held in many quarters that present-day methods of purification represent the final solution of the question, and that all that is required now is the perfecting of plants and processes. The expression of such opinions is regrettable as likely to have a malign influence upon much of the pioneer work now being carried on. The aeration process, which is essentially a highly intensified bacterial action, falls under this heading of "pioneer work," and its advantages have been summarised as follows: (1) Improved sanitary conditions, by reason of freedom from nuisance either from smell or offensive sludge, and the elimination of the fly trouble connected with certain types of filters. (2) More perfectly oxidised effluents, saturated with dissolved oxygen and with an abnormally low free ammonia content. (3) The production of a sludge which can be readily dealt with, and which, by reason of its high nitrogen content, is a valuable fertiliser. (4) Greater freedom of choice of outfall site on account of the very considerable reduction in area of works required. (5) Greatly reduced capital cost. It is impossible, within reasonable limits, to describe the process, and readers must be referred to the paper read by Mr. Edward Ardern at the last Annual General Meeting of the Association of Managers of Sewage Disposal Works. It is scarcely necessary to add that the process would require closer scientific control than is now exercised at the average works.

Sludge Disposal

Sludge disposal was one of the subjects which received the attention of Mr. John D. Watson, engineer to the Birmingham, Tame and Rea district Drainage Board, when delivering his inaugural address as president of the Institute of Sanitary Engineers. He dealt somewhat fully with the Dickson process (in use at



The Simplex Patent Rectangular Sprinkler.

The machine is constructed to travel on rails (B) fixed to the feed channel (A). The carriage is mounted on four wheels, which carry the whole of the machine, the power to propel backwards and forwards being obtained by passing the liquid through syphons (C) into troughs (D), and then on to the water wheels (E) which revolve and transmit the motion by a roller chain on to the countershaft (F) fixed on top of carriage, and from here by means of two pairs of bevel wheels to the main axle (G). The reversing is accomplished by means of rocking lever (H) coming into contact with buffers (I) fixed at each end of the machine's travel. This rocking lever works a double clutch, engaging two bevel wheels, thus reversing the motion. The water, having passed over the water wheels, is conveyed through perforated pipes (J) on to the surface of the bed. These pipes are arranged so that with a normal flow only one-half of the bed is being fed as the carriage moves in one direction and the other half when moving in the opposite direction. The pipes are arranged to come automatically into operation the full width of the bed when dealing with a heavy flow of sewage. A patent fluid brake (K) is fitted to counteract the effect of the wind, and is worked from one of the carriage axles and so constructed that it has no effect on the machine at normal speeds and only comes into operation when the speed of the machine increases, due to the power of the wind. As only one pair of rails is required, and these are of narrow gauge, the apparatus is not liable to be affected by local subsidence or lateral torsion.

Dublin) which he divided into two main sections: (1) The fermenting of the crude sludge mixed with a small percentage of yeast, and the separation of as much water as possible by this means. (2) Drying the resulting sludge, mixed in this case with certain compounds containing phosphates and potash to produce a fertiliser. Said Mr. Watson: "The introduction of yeast into the sludge evidently provides stimulating food for the putrefactive bacteria, as the rapidity with which the solid part of the sludge is separated from the liquid part is one of the extraordinary features of the process; but, however it may be designated, its merits are sufficiently conspicuous to warrant me in saying that its discovery marks a decided advance in the treatment of sewage sludge which no engineer can afford to ignore. Apart from the hygienic and profit-making elements, I attach much importance to the utilisation of the nitrogen of sludge, which up to now, has been literally thrown away." Mr. Watson installed during the year further distributors of the Simplex rectangular type (manufactured by the Ames-Crosta Sanitary Engineering Co. of Nottingham) others of the type having been working automatically for six years with a minimum of supervision. The accompanying illustration explains very clearly the working of this machine.

Water Filtration and Sterilisation

In the field of water supply there is not much to be said, for although much progress as regards purification has been made in a general way there is little of individual interest. Possibly, the greatest advances have relation to mechanical filtration, and a number of large plants for this purpose have been installed. The supersession of the slow sand filter must follow the installation of the mechanical plant now being erected, and it is common practice in such cases to convert the old filter beds into storage reservoirs. The introduction of some sterilising agent is becoming more universal, while greater care is being exercised in the addition of chemicals and coagulents. At St. Louis—where by-the-bye, a mechanical plant capable of treating 160,000,000 gallons a day has been erected—it has been estimated (or so the writer is informed) that "a saving of 30 per cent. of the chemicals will be effected merely by allowing a long period for the softening action of the lime before sulphate of iron is added, thus avoiding the loss due to chemical reactions." The main sterilising agents are ozone, hypochlorite, lime, chlorine gas, and the ultra-violet rays. The last-named method was last year adopted by the City of Niagara Falls, New York, and the event is noteworthy as it was the first municipal installation of its kind in America. Splendid results have been achieved both at home and in America with the hypochlorite treatment, and, if statistics can be relied upon, the average reduction in the typhoid fever death-rate in eight American cities where the treatment has been adopted is 51 per cent.

Refuse Disposal

Refuse disposal problems are well to the fore owing to the prevalence of military camps. It has been obviously impossible or inadvisable, in the majority of instances, to erect anything in the way of permanent structures, and rough-and-ready incinerators (many of the most primitive type) have been devised by the engineers-in-charge. There are, of course, many excellent types of small furnaces, or incinerators, on the market, and these have been largely requisitioned by the War Office, the Admiralty, and public institutions generally. The big destructor firms carried out a number of contracts, at home and abroad, during the year, but there is nothing of a startling nature to record. The question of "feed" still remains a moot one, and the estimated profits from the utilisation of the steam generated in the plants have not yet come up to expectations. Still, much has been done in the direction of this latter and much more is to be hoped for from the trade rivalry which exists. There was talk of a conference of representatives of the City Corporation and the London Borough Councils, which would consider the whole question of refuse disposal in the Metropolis, but this has been shelved. Garbage reduction versus incineration is one of the matters that would well repay full discussion, for if the claims of a certain company are correct their system of pulverisation produces a practically innocuous compound, which is readily purchased by farmers for manurial purposes. The metropolitan borough of Southwark alone sold nearly 20,000 tons last year (the sale was just over 2,000 tons in 1907) and the demand, it is said exceeds the supply. An illustration is given of a Meldrum plant erected recently at Penang, in which special provision is made for dealing with cattle and other carcases.

There is no better regulation of consistency of concrete mixture than the human eye, if the vision is skilled and conscientiously applied, says a writer in Engineering and Contracting. Because skill and conscientious application are not common in men plentifully available for mixer operations, the automatic measuring tank has become a requirement of equipment of the concrete mixer. On the average it gives better results than the human eye. There has been talk recently of returning to the open mixer and the mixer operator's skilled judgment to control consistency. It is pointed out, with reason, that no prescription of number of turns and speed of turning and of a constant wetting can equal the results possible with a skilled exercise of human judgment. The weakness of this reason is that it is an extension of the particular to the general. For certain concrete specifications, the cost of skilled operations and of time required for such control is warranted, but it is not warranted for concrete work generally. The mechanical mixer, with automatic charging drivers and prescribed methods of operation, strikes a better average of concrete cost and quality than does any other means, for all but a few scattered purposes for which concrete is employed

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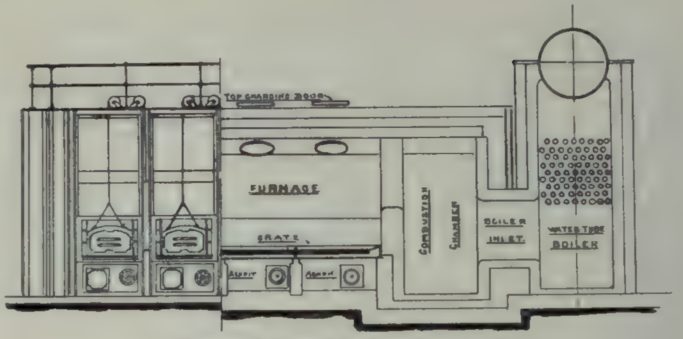
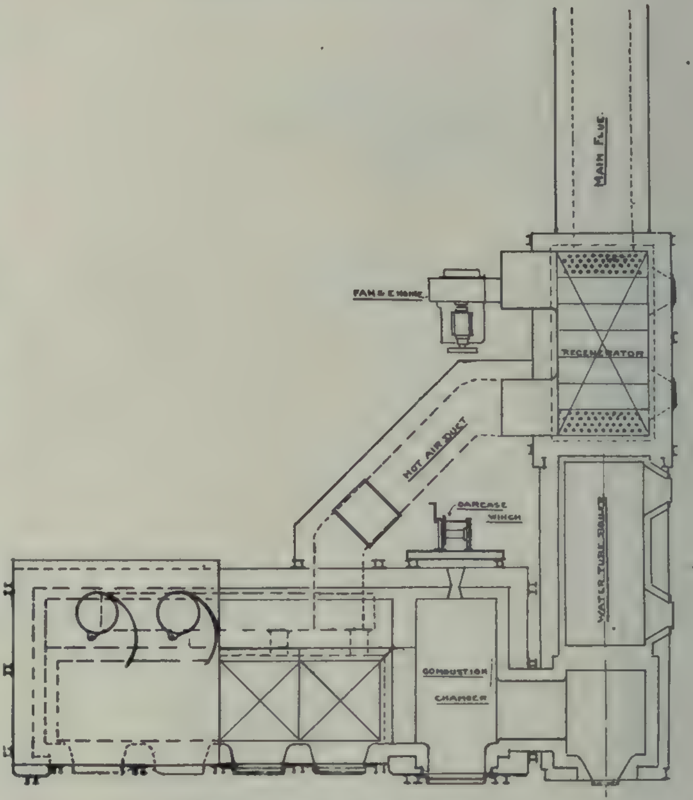
"I like a bit of ham and bacon as well as anybody, but it is the first time I have known of an architect being called in to build piggeries," said Alderman Binns, at the Knaresborough Guardians meeting, on Friday, when it was decided to pay a fee of three guineas to Mr. Illingworth for plan and specification for new piggeries on the workhouse farm. Let us hope Binns will never have to eat his ham and bacon as a welcome guest of the Guardians. If misfortune drives him to the workhouse with the rest of us, he will soon learn to appreciate the superior flavor of the product of pigs provided with properly planned piggeries. —The Building News, London.



Longitudinal section and part elevation.



Sectional plan and part top view.

Penang, Straits Settlements, Refuse Destructor

This plant, by Messrs. Meldrums, of Timperley, Manchester, is a four-cell unit, of the top feed Simplex type. It is capable of dealing with from forty to fifty tons of refuse a day of twenty-four hours, without smell, or omission of smoke or gases. The grates are continuous, but the ashpit is divided, each compartment containing an air valve connecting with the main air duct at back of cells. These valves are operated from the front, and can be shut off during the process of clinkering, etc., the other grates being in an incandescent state, thus maintaining a substantially high temperature. The cells work in conjunction with a Babcock & Wilcox water tube boiler. The regenerator consists of a number of cast iron tubes, staggered diagonally, the joints between the plates being quite air tight. The whole of the necessary air for supporting combustion is circulated round these tubes, thereby absorbing a large proportion of the heat in the waste gases, which would otherwise go up the chimney. By this means air at 300 degs. to 350 degs. Fahr. is supplied in the ashpits. The air is provided by a steel plate centrifugal fan, driven by a vertical engine. Before the gases enter the boiler they pass into a combination chamber, where a very large percentage of dust is deposited. In this plant provision has been made for dealing with cattle and other carcases, these being pushed into the large door provided in the cumbustion chamber. Every facility is provided for inspection, and for the expeditious removal of all the dust, and should firebrick or other renewals be necessary at any time, the whole plant is so designed that this can be done without the necessity of dismantling.

Highway Improvement in the Province of Ontario

THE 1914 annual report of Mr. W. A. McLean, Commissioner of Highways for the Province of Ontario, contains a great deal of interesting information, not only in regard to the actual activities of road work throughout the province, but also in regard to improved constructional methods and equipment. After a few prefatory remarks bearing upon the importance of road improvement, Mr. McLean gives the following interesting summary of the work carried out:—

Substantial progress in road construction was made throughout the Province during the year on County Road Systems subsidized by the Government under the Highway Improvement Act. Work was carried on in twenty counties, the total expenditure for construction being as follows: —road construction, $575,691.17; bridge construction, $159,925.03; superintendence, $28,850.25; machinery and equipment, $41,195.97; special county grant to townships, villages and towns, $20,021.73; total, $847,684.15.

The Provincial subsidies amounted to one-third of the foregoing, or $282,561.35; the total amount raised by the counties being $565,122.80. The greater part of the county expenditure was met by the issuance of debentures extending over periods of from twenty to thirty years; but of twenty counties carrying on construction under the Act, ten are raising their funds principally by annual rate on the equalized assessment of the county. Of the foregoing county expenditure ($565,122.80), the sum of $193,044.27 was raised by direct levy for the year and the remainder by debenture issues.

The work carried out comprised:—Roads graded, drained and surfaced with broken stone, 161.48 miles; roads graded, drained and surfaced with gravel, 90.45 miles; total mileage metalled, 251.93.

There was included also the construction of 98 steel or concrete bridges; 142 concrete culverts (arches or slab covering) ten feet or less in span; 605 tile culverts; and 60 miles of grading in preparation for the next season's work.

The expenditure by twenty counties was $847,684.

Bituminous Road Construction

By W. A. McLean, Commissioner of Highways for Ontario

BITUMINOUS roads may be broadly defined as those in which tar, asphalt or asphaltic oils are used as a binder for stone, gravel, sand and slag—or as a protective coating in forming the wearing surface. One of the earliest instances of bituminous construction in Ontario is found in the old tar sidewalks, once common throughout the province, in which gravel, intermixed with tar, was used. Later, tar macadam roads were constructed, in which broken stone mixed with tar was employed—notably in the city of Hamilton, where a number of these old tar macadam streets are still in use. Sheet asphalt is a well-known instance of bituminous road, in which, over a concrete foundation, is spread a coating, usually two inches in thickness, consisting of asphalt and sand—approximately 90 per cent. of sand and 10 per cent. of fluxed asphalt.

The tar preferred in road construction is produced in gas-house retorts in the manufacture of gas from coal. Tar is also obtained in the water-gas or oil-gas process. Pitch, frequently referred to in connection with bituminous roads, may be described as a solidified tar obtained in the evaporation or distillation of crude tar. And refined tar is a tar freed from water and brought to a desired consistency by evaporation, or is a tar especially prepared by the mixing of tars, oils, or distillates to produce a desired consistency. Asphalt is a native bitumen or tarry material occurring in large lake-like deposits, such as those in the Island of Trinidad and in Venezuela, or is a residuum obtained in refining certain petroleum oils such as those obtained in Texas and California. A flux is an oil used in diluting tar or asphalt to a desired consistency for use in the road.

Bituminous road surfaces, rightly built, produce a minimum of noise and dust. They are durable and provide a good foothold for horses; are smooth and agreeable to drive on; and are a most desirable type of construction.

Economically, however, bituminous treatments on country roads are suitable only for heavy or moderately heavy traffic, especially that of motor vehicles. As compared with a gravel or waterbound macadam road, if traffic is very light, the use of bituminous surfaces will increase the cost of maintenance; if traffic is heavy, they reduce the cost of maintenance.

The tendency of motor traffic is to remove the dust and fine material from between the stones of a common macadam road, with result that the stone becomes loose, and the surface "unravels." When traffic is such that this unravelling of the surface becomes marked, the need of bituminous treatment is indicated, as a means of reducing the cost of maintenance.

A road may not need the same class of surface from end to end. All depends on the amount and class of traffic. A road entering a city or town may need bituminous treatment within, and for a mile or two distant from the town; at which point traffic may have become so diffused that a common gravel or macadam surface will suffice, and will be the most economical. On the other hand, traffic on a main road between two cities may be such that proper service and economical maintenance will strongly indicate the value of a surface protected by or bound with bitumen for the entire distance. As previously stated, the amount and class of traffic will indicate the proper method to employ; not merely the existing traffic, however, but the traffic to be anticipated as the result of an improved road.

A road or pavement may be conveniently divided, for consideration, into four parts: (1) the system of

Sarnia model road—concrete mixing outfit.

drainage; (2) the earth subgrade; (3) the foundation; (4) the wearing surface.

Foundations

A secure foundation is an absolute necessity for permanent bituminous coatings. To this end a substantial depth of foundation should be used, a condition with which roads on this continent have not always complied. Very few conditions of heavy or constant traffic can be successfully met with a less foundation than 6 to 8 inches, or a less total depth of stone in the road crust than 10 to 12 inches. The price of good roads in one particular, at least, is a substantial depth of stone. The difficult part of our problem, a financial aspect, is not so much the selection of a wearing surface as our ability to pay for strong foundations. The existing foundation, or local materials available for a foundation, will frequently dictate what the surface should be.

Heavy motor trucks and buses are placing a great and unexpected strain on road foundations. On main roads leading out of London, England, old 6-inch concrete foundations are being torn up and 9-inch foundations put in their place. This is necessitated by

Sarnia model road—mixing cement and hydrated lime.

Wolfe Island model road—quarrying.

heavy and constant motor-bus and traction engine traffic.

In Great Britain, France and other countries of Europe, bituminous treatment has largely become the accepted practice in meeting the requirements of motor traffic in the open country; by carpet coats; by grouting or penetration; and by mixing methods, according to local conditions. It need not be said that asphalt and tar are now, on this continent, being used with marked success—a result that has been reached after many trials, and not without tribulations.

That bituminous paving has been markedly successful in England is probably due, to a large extent, to the fact that it has been commonly applied only on old, solid, and well-settled foundations, in resurfacing their old telford and macadam roads. Many of the failures on this continent, on the other hand, have plainly been due to weak, badly-drained foundations. To uneven settlement of new roads under traffic may be attributed much of the failure of bituminous surfaces, rather than to any inherent defect in bitumen itself for road purposes.

Roads, as we now build them, are rolled in several layers with a ten or twelve ton roller, giving a com-

York County—spraying tar on Dundas Street (Eaton Road).

York County—repairing bituminous surface on Dundas Street (Eaton Road).

pression of 500 lb. per inch. Traffic follows with tire compression up to 700 and 800 lb. per square inch. Under succeeding wet conditions of fall and spring, settlement must inevitably occur, leading to an uneven, wavy surface and consequent decay.

A broken stone road commonly does not reach final settlement for two or three years after first construction, but within that period permanent subsidence may be taken for granted. French and English road-builders laying bituminous surfaces over their old roadbeds, are manifestly not dealing with a condition which commonly exists here.

A reasonable course to pursue in many cases would be to build waterbound macadam roads on telford or other suitable foundation. The surface could be maintained for two or three years by thin carpet coats or by oiling. At the end of that period perfect settlement and stability of the foundation having been attained, a heavy and durable bituminous surface could be applied where traffic demands it.

Consideration of methods of using bituminous materials may be under the following heads:—(1) Carpet coats; (2) Penetration Method; (3) Mixing Method.

Carpet Coats

A Carpet Coat, as the name indicates, consists of a thin covering of tarry or asphaltic material spread over the surface of a broken stone road. Two purposes are served:

(1) The surface of the road is protected from wear

Wentworth County—stone-crushing outfit. Observe wagon boxes, holding one-half cord, or two and one-third cubic yards.

Halton County—Concrete bridge constructed by Nassagaweya township.

and unravelling; and (2) dust is effectively prevented. The materials used for the purpose may be an asphaltic oil, asphalt fluxed with naphtha and oil, or a tar suitably fluxed. A sufficient proportion of flux may be used to permit cold application; or the material may contain so high a percentage of bitumen that it must be heated for application.

For best results, the road should be well constructed, with a smooth surface, free from ruts or holes. Before treatment it should be thoroughly cleaned to remove all dust and to leave the stone exposed. When a road is treated with a heavy oil, one containing a high proportion of bitumen, it is usually covered with a light coating of stone chips or pea gravel to prevent stickiness, and give a more definite wearing quality to the coat. The quality of oil required varies with the character of the material, but ordinarily about ¼ to ½ gallon to the square yard is used. A thin, tough and uniform film should be sought, rather than a thick covering.

The life of a carpet coat depends on the amount and nature of traffic to which the road is subjected, the quality of material used, methods of application, and the provision for repair and maintenance. Light oils containing up to 40 per cent. of asphalt may need renewal several times in a season. A cold application of tar should last a season, and the effect should be apparent the next summer. Hot applications of tar or heavy oils containing 80 per cent. asphalt, are more durable, and with a system of repair rather than renewal, should last two seasons.

Oils and tar may be purchased by the barrel, but if the extent of the work permits, it is cheaper to buy in tank cars containing 6,000 or 8,000 gallons. If light

Lanark County - county bridge near Fallbrook.

material, it may be drawn by gravity or pumped to the distribution wagons; but if heavy bituminous material, it must be previously heated. For that purpose steam coils are provided in the cars, and steam forced through from a portable boiler of about 20 h.p.

Light oils are usually applied to the road from common tank wagons, the sprinkler being provided with suitable perforations. The distributor should be adjustable in width from 6 to 12 feet so as to avoid the application of narrow strips. The rate of application may be controlled by the rate at which the team walks. Hot (and heavy) applications, however, may preferably be applied from pressure distributors, of which there are various kinds. In one type the oil is forced through a series of small nozzles under a force obtained by maintaining an air pressure in the top of the tank. In another type of distributor, the oil or tar is atomized by air pressure, very much as in oil burners, or as in medical atomizers, the liquid being converted into a fine, misty spray. When applied by pressure distributors, the material is forced into the surface of the road, not only adhering more tenaciously, but is driven downward into the road. These distributors are filled with interior steam coils, and are drawn by a traction engine or steam roller. Steam connection may thus be made with the tractive power to keep the tar or oil properly heated to about 280 deg. F. A distributor should be capable of distributing evenly from ¼ to 1½ gallons per square yard. A pressure distributing wagon of about 600 gallons capacity will cost about $750. Should the work not be of sufficient extent to justify the purchase of such equipment, recourse may be had to a 500 gallon melting wagon and a hand distributor mounted on wheels. A hand distributor holding about 30 gallons is adjustable with a maximum spread of 20 inches, and costs about $75.

Penetration Method

"Bituminous macadam," as the name indicates, may be described as a broken stone road, bonded with tar or asphalt, the bituminous material being poured hot into the interstices of the stone. A four-inch layer of stone (such as is retained by a 1½ inch ring and will pass a 2½ inch ring) is first spread evenly over the foundation, and rolled to an even surface. Into this the heated bitumen is poured. The pouring may be done either from small cans or from large tank wagons from which it is sprayed under pressure. A penetration of about 2½ inches is usually sought, using about 1¾ gallons of bitumen to the square yard. Over this is spread a light coat of stone chips, and the surface is then thoroughly consolidated by a steam roller. It is good practice to then give a paint or squeegee coat of bitumen (about ¼ gallon to the square yard), adding another sprinkling of stone chips to dry the surface, which is again finally rolled.

In the penetration method the tar or asphalt have commonly been poured by hand, using distributing pots made for the purpose; the bituminous material being heated in portable or semi-portable melting kettles of from 50 to 500 gallons capacity. This method, however, is slow and expensive, and results are seldom satisfactory; the tendency being to overheat the bitumen or to apply it too cold. The pressure distributors as described for use in laying carpet coats are more satisfactory for the work, and cost very little more than say two melting kettles (at $400 each) with additional hand-distributing pots and buckets. For small sections of work the hand distributor mounted on wheels with a strong 500 gallon melting wagon will give reasonable service; but will complete about 250 square yards per hour as compared with 800 square yards completed by a good distributing wagon, using one and a half gallons for the first pouring and one-quarter to one-half gallon per square yard for the flush coat.

Mixing Method

Tar macadam roads were originally made by mixing crude coal gas tar with broken stone. The mixing was done on boards by hand, very much as concrete is mixed by hand. The results, while indicating the value of bituminous macadam, were uncertain, owing to the inferior process of treating the materials. When sheet asphalt was introduced, the industry created a more rapid development of paving plants. A better understanding of the materials has been obtained, however, and efficient equipment has been devised for handling them.

Bituminous concrete is a surface made by the mixing method. Over a layer of broken stone is first sprinkled a light coat of tar as a "binder coat," to unite the surface to the foundation. On this is spread a layer of stone with which hot asphalt or tar has been previously mixed. Mixing was first done by hand, but the practice is now to pass the material through a plant which heats and dries the stone, and in a revolving process similar to the concrete mixer, coats all particles of stone with bitumen. The coated material is then conveyed to the road, spread and rolled to a depth of two to three inches. This is treated with a squeegee surface, as in the case of the penetration method.

The mixing method is more expensive than the penetration method, but bituminous concrete is more certain in its results, is more desirable, and will support heavier traffic than will bituminous macadam. In the mixing process, a maximum density of aggregate is sought, using stone carefully graded from fine to large.

One method of proportioning aggregate for maximum density was patented (Warren's Bitulithic), but similar results are now sought under what have become known as the Topeka Specifications.

The Topeka specifications provide an aggregate mixed as follows: passing a 200 mesh sieve, 5 to 11 per cent; passing a 40 mesh sieve, 18 to 20 per cent; passing a 10 mesh sieve, 25 to 55 per cent; passing a 4 mesh sieve, 15 to 22 per cent; passing a 2 mesh sieve, not over 10 per cent.

"Tarmac," one of the most successful proprietary mixtures used in England, consists of iron slag, bound with tar. It has been described to the writer by an English authority as more nearly "fool-proof" than the majority of other combinations, in that inferior or careless workmanship seems to be less likely to cause bad results. The mixture of tar and slag is shipped in cars from the manufacturer's plant, ready to be applied cold to the road.

Another proprietary form of bituminous pavement is mixed with stone at a central quarry and is shipped by rail for cold construction. Sand in some cases is mixed with the bitumen for use in the penetration process. A variety of minor distinctions might be enumerated.

Ordinary sheet asphalt, which may be included under this heading, consists of about 10 per cent. bitumen and 90 per cent. sand, usually laid two inches in thickness on a concrete foundation. This material has not been used for roads in the open country; but a concrete foundation with a bituminous surface has been employed in some cases.

An adequate mixing plant has three duties to perform: (1) it must heat and dry the sand and broken stone; (2) it must melt and prepare the asphalt, tar or other bituminous material; (3) it must intermix the sand, stone and bituminous material.

The best results require that proper proportions of the mineral aggregate (sand, stone, etc.) and bituminous material will be ready at one time—all moisture will be driven out of the sand and stone, that these with the tar or asphalt will be heated to the proper temperature, and that they will be mixed with precise uniformity. The most elaborate equipment for mixed bituminous surfaces is found in the permanent asphalt mixing plants in large cities, owned by the municipalities themselves or by paving contractors who are doing city work, principally for the construction of sheet asphalt. In Ontario, such asphalt plants are owned by the cities of Toronto, Hamilton and Ottawa. These consist of steel buildings containing large cylindrical dryers, mixers with capacity of 15 cubic feet, conveyors, independent motors, etc., and cost about $35,000. Such plants should turn out about 50 tons of mixed material per hour, or sufficient to lay 500 square yards of two-inch surface (compressed).

Smaller plants, semi-portable, are so constructed that they can be taken down, shipped from place to place, and set up without great expense. They are useful for contractors doing limited pieces of work in the smaller cities and towns. The cost, exclusive of covering, is about $8,000, and the capacity is about 7½ tons or 75 square yards of two inch sheet asphalt per hour. They consist of a heating drum for the stone and sand, a melting pot for the bituminous cement, a mixer and minor equipment.

Railway plants, built on flat cars, are useful. They can readily be moved from place to place, are readily taken down and set up, and are fully self-contained. The better types have a capacity of about 17½ tons per hour, or 175 square yards of two-inch sheet asphalt. The cost is about $14,000.

A still smaller, but less efficient, machine is somewhat similar to the concrete mixer. The machine is mounted on wheels; and the distinctive feature from a ½-yard cube concrete mixer, is an oil torch for heating the stone just before adding the bitumen. The bitumen is heated and measured separately, and the materials are passed through the mixer in batches in the same way as the concrete. It is usual to heat and dry the stones before putting in the mixer, and this may be done by means of wood fires in pipes under the stock piles. The stone should also be covered with tarpaulins to protect it from the rain, as the mixing may otherwise be seriously delayed. These machines should be used in pairs in order that the men may be kept busy when the stone is being heated in each separately. The capacity of one of these mixers is about 22 square yards of two inch surface per hour. The output of two would be about 360 square yards in a 9-hour day. If sand is omitted from the mixture, the output may be considerably increased, and as high as 600 square yards per day are reported from one machine. A mixer costs about $1,800; and necessary tools would be about $400 additional.

Uniformity is desirable with all classes of road surfaces, and is particularly necessary with bituminous roads. The foundation should be of uniform strength, so that it will not settle in depressions. The surface material should be of uniform thickness and wearing quality. When a carpet coat is applied, it should be spread evenly, over a smooth surface. In penetration work, the bitumen should be forced to a uniform depth, and the stone should be of uniform size. In the mixing method, the materials should be uniformly proportioned, using the various sizes of fine stuff, sand, stone and bitumen, in carefully and evenly graded quantities.

Welland—brick pavement on Cross Street.

Machinery and equipment that permit the maximum uniformity of mixture or application are most favourable to good results. It must be impressed, however, that no machine alone has intelligence, and that skilled, attentive and experienced operation is a primary consideration. Many excellent roads have been built and maintained by the use of bituminous materials. On the other hand, a number of failures may be recorded—as with all classes of road material. But occasional failures have occurred when apparently every rule had been complied with—the cause could not be defined. For this reason, the use of bituminous materials involves a measure of risk—not great, it is true—which does not attach in the same degree to some other pavements.

Precautions and Practice in the Restoration of Old Buildings*

By W. A. Forsyth

ALL repairs or replacements should be distinctive, yet harmonious, for they form part of the story in stones. If the truth of the story is veiled by attempts at imitative reproduction the values of the building are lost.

Precautions

It is important that such structural works as underpinning be not too hurriedly decided upon and carried out. Ample test and observation must be made, for it is known that many a building was safer before than after that operation.

Materials used in repairs should, as far as possible, be new, and local traditional custom should influence their choice and method of building. The use of old materials from other buildings is misleading, and tends to create an undesirable market in such commodities. All old materials, however, such as glass, metal, etc., must be carefully collected and stored.

The tendency to over-repair should carefully be avoided: anticipated defects must not be considered, as a great deal of wanton injury will thereby be perpetrated.

Above all it must be remembered that repairs cannot be hastened; slow-setting materials are invariably those of greater lasting quality.

Any additions that may become necessary should be designed in a different manner from the old buildings to which they are to be attached. They need not be unsightly, although possessing a modern character, so that no mystery need be cast upon the structural story of the fabric.

Grouting

Repairs are chiefly required for old walls more than any other features. These have invariably become defective from their faulty bonding, from roof thrusts, or from weak foundations. The solidifying of the walls is usually necessary before such operations as underpinning, the insertion of damp courses, the provision of tie rods, etc., can be commenced.

No greater advance has been made in the repairing process in recent years than in that of grouting. Many a condemned building has been saved and many a weak structure made sound by this means, and more particularly when used under pressure.

The injurious effects of vibrations upon ancient buildings, especially those having rubble-built walls, due to fast and heavy modern traffic, is a matter of grave importance.

It frequently happens that a fractured rubble wall, a weak footing, an insecure bridge, has failed, and can only be repaired by first consolidating the masonry before foundations or other repairs are dealt with. Briefly stated, the method of applying cement grout under pressure is as follows: The operation, like underpinning, must be performed in small sections. All loose, dry mortar and dust is first removed; that which escapes, after being raked from the open joints, is blown out. Great care must be taken not to dislodge the aggregate of the wall—that is, the rubble, the bricks or stones, as the case may be. Large facing stones should be wedged up.

The parts of the wall thus cleared should then be well saturated, also under pressure, by wet clay. This moistening will slake the inert properties of old lime, and assist the process of solidification. The grout, mixed according to requirements, is then forced by the machine into the wall through a small aperture left for the purpose. The clay joints should be watched, in case the grout escapes prematurely; experience will determine when the particular section is fully grouted.

It is usual to use mortar of one part of cement to one part of sharp, but not too coarse, sand. Frequently neat cement is injected into the fissures. The effect of these injections is to solidify the wall, leaving it in a state reasonably safe for the underpinning, the cutting out of cracks, and bonding in strong material, or other operations.

The clay sealing of the joints is removed after ordinary setting has begun to take place, when it will usually be found that the grout has fully penetrated the wall or structure under treatment. It is then desirable to point the more open joints of the external face to exclude weather. It is not necessary, however, to point internal joints, but to leave them open in order to show that the old materials have been grouted. Grouting by hand has its limitations, and is dependent upon gravitation. Under mechanical pressure the liquid rises to considerable heights and travels surprising distances.

There are occasions—usually in thick walls—when hydraulic blue lias lime mortar would be adequate as a grouting medium. Expansions and, in many stones, an unpleasant discoloration are then avoided.

Lime grout is very desirable where walls have not fractured but have hollow places. Lime mortar built walls have endured a sufficient time for all ordinary purposes. There are many limes which harden to a very great degree. "Smeaton" used Leicestershire limes in the erection of lighthouses. One of the Derbyshire limeworks has been working continuously for seven hundred years.

A great advantage of this method of repair is that the two faces of a wall are maintained during repairs.

Winchester Cathedral has been saved by grouting. Sir Francis Fox has also grouted and saved historic bridges condemned by county authorities; he has so treated the walls of a large institution when the entire rebuilding was threatening the trustees, whose finances could not bear the strain; he has grouted the walls of an early eighteenth-century London building upon which a dangerous-structure notice had been served by a watchful district surveyor, who, after testing the repaired house, accepted the process for the more customary one of demolition.

Many a condemned external or party wall is pulled down when grouting and bonding in of new work would have rendered the structure safe.

Masonry

The superficial decay of stonework is largely due to atmospheric causes, which are usually more aggressive in the neighbourhood of large towns.

No moulded or carved feature should be on any account reproduced either in stone or any other material. The Society for the Protection of Ancient Buildings has always recommended that badly decayed ashlaring be rebuilt in roofing tiles laid horizontally and rendered in mortar.

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* Abstract of a paper presented before the Institution of Municipal and County Engineers, London, Eng.

The same methods are applicable to brick walls, and have the great advantage of ensuring the pinning up of the new material where such is not always possible with the insertion of large stones or bricks.

When a weak wall cannot be grouted, and it is only possible to repair by bonding in new material, it is important that the more interesting face be retained at the expense of the less valuable.

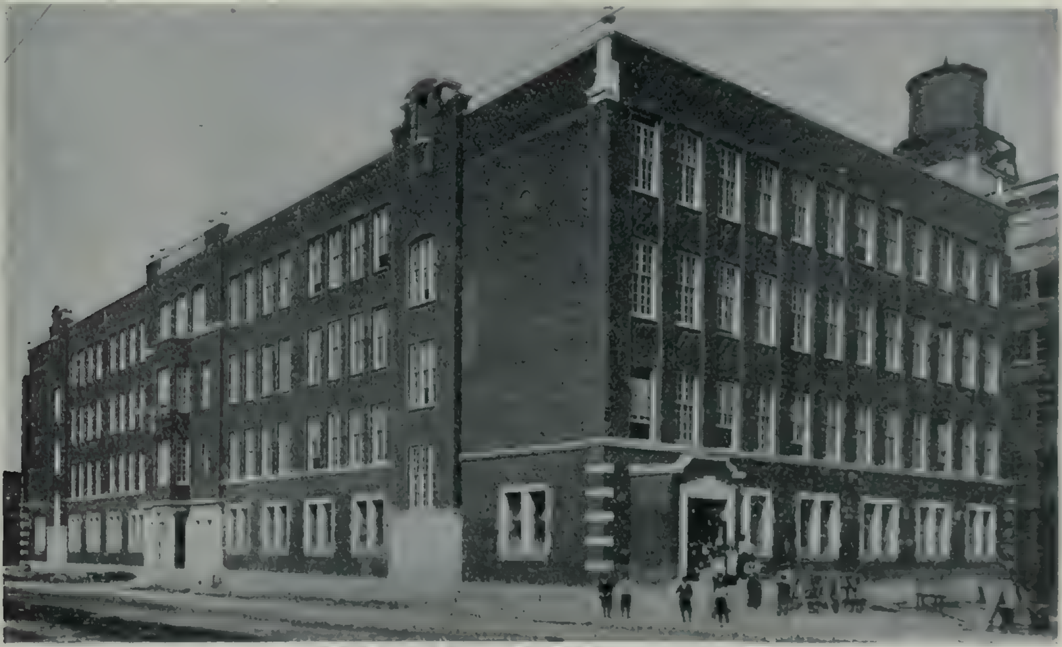
Rubble facing which has become loose should be repaired by re-using the old stones or flints, cleaning and mixing them with lias lime mortar stiffened by a small proportion of cement, and the whole laid in and worked up to a form board, after the manner of concrete building.

In less decayed rubble facing the loose members may be reset and pinned in with a roofing tile. This was a mediaeval practice.

In the repair of masonry and brickwork reinforced concrete can be structurally used to advantage in footings, floors and lintels. The proportion of steel to concrete must not be unduly large, but sufficient for taking up tensile stresses, and the metal must be well covered by the concrete.

The Bancroft School, Montreal

ONE of the finest schools in the city of Montreal has just been completed from plans by Nobbs and Hyde, architects, who have designed several of the city schools. The building, erected for the Protestant School Commissioners, is known as the Bancroft School, and is on St. Urbain Street, in the northern part of the city. It is on a site 245 x 90 feet, exclusive of a playground, 60 feet long, at either end. The building consists of four storeys, the exterior being of a very attractive appearance by reason of the employment of rustic brick with pressed brick facings and diaper work patterns. On the ground floor there are terra-cotta panels characteristic of school life. The base is of dressed Montreal limestone, with Queenston stone stringer course, and trusses and finials at the top. The windows on the lower floor and the entrances have dressings of the same stone. Above the main entrance are the words "Bancroft School" in bronze lettering, set out from the face of the wall.



The Bancroft School, Montreal, upon completion.

The ground flood is occupied by playing rooms and a gymnasium. On the north side is the boys' playing room, and on the south the girls' playing room. These have asphalt floors, buff brick dadoes, and plaster walls and ceilings. At the rear are lavatories, with terrazzo floors, enamelled brick walls, and marble divisions. From the main entrance hall and vestibule—finished with tiled floors and buff brick walls—a flight of steps leads to the gymnasium, which has wood floors, buff brick dadoes, silica brick walls, and plaster ceiling.

The greater part of the next storey consists of class-rooms. In the centre of the front portion of the building is the principal's office, while at the south there are kindergarten rooms. Other rooms include the teachers' common room, medical room, cleaners' room, and lavatories. On this floor, as in the others above, a large corridor divides the rooms, and along the sides are placed metal lockers for children's clothes. This corridor has a terrazzo floor with a linoleum centre, the walls and ceiling being of plaster.

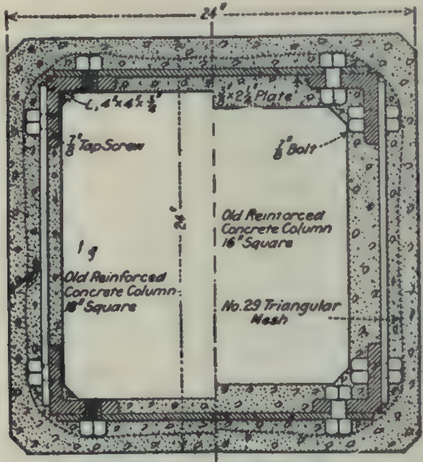
On the third and fourth floors are more classrooms, two of the largest on the third storey being devoted to manual work and cookery. All the floors are of steel beam construction, encased in double concrete slabs overlaid with hardwood. There are a cement dado, and plaster walls and ceilings. The doors have steel frames. The stair treads are of slate, and the landings of terrazzo. The windows on the ground floor have metal sashes. The roof was built to the Barrett specification.

Leading off the entrance to the upper storey is a roof playground, made of sheet asphalt, and surrounded by a wrought-iron railing. The chimney, of pressed brick, is 45 feet above the roof.

The general contractors were A. F. Byers & Company, Limited, Montreal. Sub-contracts were carried out and material supplied as follows:—Facing bricks, National Brick Company of Laprairie, Limited, Montreal; interior bricks, Milton Pressed Brick Company, Limited, Toronto; heating and ventilating, General Fire Extinguisher Company, Montreal; plaster work, Watson & Wilson, Montreal; roofing and paving, G. W. Reed and Company, Montreal; painting, Fryer and Matheson, Montreal; glass, Hobbs Manufacturing Company, Limited, Montreal; lockers, Office Specialty Manufacturing Company, Montreal; and millwork, William Rutherford & Sons Company, Limited, Montreal.

Reinforcing Concrete Columns to Carry Additional Storeys[*]

It was necessary to resort to a somewhat unusual method of construction in the addition of two storeys on the machine shop of the Washburn-Crosby Company's mill in Minneapolis, Minn. This structure was one of the first reinforced-concrete buildings erected in that city, and covers an area of 60 by 78 ft. It is five storeys high, has brick-bearing-walls strengthened by brick pilasters and six interior reinforced-concrete columns. The floor construction is of the girder type, 6-in. slabs with two-way reinforcement. The wall footings went down to bedrock, about 9 ft. below grade, but no accurate data could be found regarding the size or depth of the six column footings. On figuring the old structure, the writer found that the concrete columns were not of sufficient strength to carry any additional storeys; they were actually too weak for their present requirements. Neither was the roof-slab, of course, strong enough to be utilized as a floor. In fact, the only parts of the building that would stand additional loading were the walls.


24"
L 4½x4½x⅝
⅜x2¼ Plate
⅞ Tap Screw
⅞ Bolt
Old Reinforced Concrete Column 16" Square
Old Reinforced Concrete Column 18" Square
No. 29 Triangular Mesh

Half Section at 1st and 2nd Floors

Half Section at 3rd and 4th Floors

Half sections through columns, showing method of reinforcement

Another condition that added to the difficulty was that neither the continuous use of the elevator nor the lower four floors of the building could be interfered with, and as two floors were used for flour storage, it was essential to guard against leakage. Obviously the first step was to examine the column footings, to see whether they rested on bed-rock and were of sufficient size to carry the additional load. They were uncovered, and five of them were found to go down to the limestone ledge, while the sixth one rested on a layer of shale about 18 in. thick. To secure solid bearing this footing was "plugged" in sections of about 1 ft. width, and in that way carried to the ledge. All of them were in good condition and of ample size.

As the old concrete columns could not be utilized, it was decided to transmit the load of the new storeys to the footings by means of structural-steel members built arount the old columns. Four holes were cut in the floor-slabs at each column and 4 by 4 by ¾-in. angles lowered down from the roof to the footings. They rested on a structural-steel base, made in two parts and bolted together. The angles were connected by ⅜ by 2¼-in. straps every 6 in. alternating, ⅞-in. tap-screws being used for connections at the two lower floors, where the original columns were 18 in. square, and bolts on the upper two floors, where the old columns were 2 in. smaller. After the angles were connected up, No. 9 triangular mesh was wrapped around them and the concrete for fire protection poured, one floor at a time. The finished columns were 2 ft. square, an increase of 6 in. over the old ones.

The old roof-slab and the fifth-storey columns were then wrecked, structural-steel caps bolted to the tops of the angles and the columns for the new superstructure poured on these.

The new floors were of flat-slab construction, without drops or column heads. Three weeks after the old roof-slab was wrecked the new one was poured, and not a single sack of floor had been spoiled although the rainfall had been considerable during that period and stopped construction for several days.

Modern Building Tendencies in the Central United States

To trace the trend of modern practice in building construction is a complicated problem; but Mr. Virgil D. Allen, Commissioner of Buildings, Cleveland, Ohio, sketches in the Cement World the direction in which constructional issues are progressing in Ohio and neighbouring States. In residential structures, he thinks, frame construction is slowly giving way to brick and stucco construction. More consideration is being given to sanitation, heating and ventilating than ever before; and there is a decided improvement in the architectural features.

The older buildings were very much cluttered up with fancy cornices, porches, etc., while the interior finish was full of panels, bead work, and mouldings. Now the lines of finish are more severe. There is also some disposition to use the bungalow type of residence. There has been a large increase in the tenement type of residential structures in the last few years, but the time is approaching when return will be made to the separate house.

In factory and mill buildings are to be observed the greatest changes. There has been a large increase in the size of such buildings, while more attention is given to the lighting, ventilation, and sanitary facilities, not only for humanitarian reasons, but because of the demonstrated economical value of such equipment. The modern factory is being provided with rest rooms, lockers, hospital facilities, and a number of comforts and conveniences for employees which a few years ago would have been considered foolish and unnecessary.

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[*] P. R. Prufert, engineer, John Wunder Co., building contractors, Minneapolis, Minn., in the Engineering News.

Much more attention is being given to the adaptability of the building for the business to be conducted therein. In times past the practice was to build and put the processes into it. Now the usual method is to lay out the processes and build the building around them. There is also a marked tendency to give attention to the architectural appearance of industrial plants, not only as applying to the individual units, but the entire plant arrangement.

There is an increasing use of fireproof materials in building construction, and more and more attention is given to the elimination of the fire hazard, not only to property, but to life. This is effected by the use of sprinkler systems, the elimination of all unnecessary woodwork, the use of metal sash and wired glass in windows, the protection of exposures by fire doors and shutters, the enclosing of all vertical openings for belts, elevators, and stairways by fire-resisting partitions, and close attention to the construction of electrical and heating installations.

Proportioning Concrete and Checking Quantities for Pavements

By Louis D. Kelsey*

IN all the concrete pavements and sidewalks laid in this city, only screened sand and gravel have been used. This material is obtained from the bed of the Chehalis river, and the pit material is screened and washed before delivery to the scow.

Our pavements are all of two-course construction, consisting for the most part of a 6-in. base and a 2-in. top. The base contains enough water so that, when tamped, the surface will flush and none of the mortar will be taken by it from the top concrete after it is placed. This base also makes a solid body upon which the workmen can walk in spreading the 2-in. top, doing away with any chance of the workmen tramping holes in the base and allowing them to fill up with the surface mortar, thus insuring us a straight two-course pavement. The top course is mixed as a very soft mortar that is easily rodded to the shape of the crown desired.

In our lower course we call for 1 sack of cement (94 lbs.) to be used in each 12 sq. ft. of 6-in. base in place. This is based on 1 sack of cement to each 6 cu. ft. of mixed concrete, sand and gravel to be proportioned as 3 to 5, or as directed. The "as directed" clause is placed in our specifications for the reason that our materials vary as to fineness, making it necessary often to shift our proportions of sand and gravel as they require.

In our 2-in. top course we call for one sack of cement in every 14½ sq. ft. of 2-in. top in place, aggregate mixed 1 sand to 2 pea gravel, or as directed.

The inspector can, by checking the sub-grade and keeping the base and top to the required thickness at the time they are placed, compute the amount of cement used against the amount required under the specifications. On the work where a boom mixer is used, the inspector takes a check on each move of the mixer, which is about every 20 ft.

In our concrete sidewalk construction we call for 1 sack of cement to be used in each 24 sq. ft. of 3½-in. concrete base in place, aggregate proportioned 1 sand to 2 gravel, or as directed. This is based on 1 sack of cement to each 1 cu. ft. of mixed concrete. In place of calling for a straight proportion on the ½-in. top for sidewalk work, that is, 1 cement to 2 sand, we limit the contractor to 1 sack of cement (94 lbs.) to be used in each 15½ sq. ft. of sidewalk in place, top and bottom included; the top to be composed of sand and cement in such proportions as will not exceed the limit as set in the specifications for the distance that 1 sack of cement will run. For the most of the sands which we have used, we have found that this is very close to a 1:2 proportion.

This system of specifying how far a sack of cement shall run in concrete pavement and sidewalk construction, we have found, has some good advantages from an engineering point of view.

First: We have found that we can handle a job with only one inspector, whereas in many cities using the other method of mixing—that is, straight proportions—they are using two inspectors, one at the mixer and one at the grade where the concrete is being placed.

Second: From this method of specifying, the contractors, in making up their bids, can compute the amount of cement that is actually required on any certain piece of work, and it also guards against the contractor shaving his price at the time of letting the contract on the theory that he can run a leaner mixture than is called for.

Third: The inspector on the work, after once adjusting the proportions of sand and gravel desired, has as his duty the watching of the cement, the empty cement sacks, the sub-grade and the placing of the concrete, and by measuring up the base at intervals, can at once detect any change in the proportions of sand and gravel.

Within the last two years we have placed some 20,600 sq. yds. of two-course concrete pavement and 17,000 sq. yds. of concrete sidewalks under this type of specification, and we find that this method is giving us good satisfaction.

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[*] City Engineer, Aberdeen, Wis.

A writer in the Commonwealth Engineer describes the reinforced concrete sleepers that have been laid in Adelaide, S. A., to carry tram rails. The sleepers used are reinforced in conjunction with a metal shoe, on which the rail rests. The shoes are connected with reinforcing rods, and these are strengthened by intervening braces. The whole forms a truss bridge, which in itself is very strong, and is further strengthened by the addition of concrete. The ironwork of the sleeper is placed in a mould, into which the concrete is poured, and the necessary tamping is done to ensure that every crevice is filled. The bottom of the sleeper has a concave surface, which is considered an improvement on the usual flat bottom, as it gives a better grip of the road bed. When the sleepers are laid the rails do not come in contact with the concrete, and all vibration is taken on the shoe. The initial cost per sleeper is considerably higher than in the case of wood or steel, but the durability is said to be immensely greater.

When grouting the joints of sewer pipe the grout should be poured from one side until it flows around and begins to fill the opposite side, when the pouring should be finished from that side. This causes a wave action that insures close filling at the bottom of the joint.

LETTERS TO THE EDITOR

Constructional Operations in the Winter Season

Editor, The Contract Record:

Your editorial published under the above heading in your issue of October 13 opens up a question of great importance to the building industry. Undoubtedly there is a tendency to get things finished up before the severe weather sets in, staving off the commencement of new work until spring arrives and the frost is out of the ground.

Where one has to start excavating into three feet of frost it is much more costly, whichever way it is done—whether by thawing out the frost by fires, or by getting it out with chisels and hammers. But assuming that this operation has been performed, and that the foundation walls are in place, the work can be carried through the winter—and it is done quite often. A case in point is the Williams Building at Toronto—a ten-storey, reinforced concrete structure. This building was commenced in December four years ago. The foundations were carried to rock. When the work reached the surface a severe cold spell set in, and it was decided to postpone operations for a time. This lasted about a month, after which the work was resumed and the building completed in the fall. This was the coldest winter we had had for ten years, and the main reason for stopping was because we were at the lowest storey, where the greatest stresses would ultimately come. If we had been at the upper storeys, work would probably have been carried on by the aid of salamanders.

There is no insuperable difficulty in carrying out work in the winter. The factors are higher cost and more attention, and these may well be offset by renting the premises six months earlier.

Yours truly,
S. H. PENLINGTON.

Toronto, October 27, 1915.

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Winnipeg City Engineer's Views

Editor, The Contract Record:

For several years the City of Winnipeg has constructed concrete trunk sewers during winter to give employment to a large number of men who would otherwise be unemployed and kept by charity.

The construction of these concrete sewers has been carried along without failures, and with no great difficulty. The aggregates are heated usually over and about a long cylindrical furnace having chimney at one end and the firing door at the other. The water is heated in a boiler before being mixed with the aggregates. During very severe temperatures it is found necessary to maintain coke fires in the trench, and as soon as the concrete is slightly set it is covered with earth.

A comparison of the cost of doing this work in the winter time with the cost of similar work in the summer would not be pertinent in the discussion which you have raised, on account of the fact that the work is carried on in winter by labourers, of whom two-thirds to three-fourths are unskilled in this class of work, and in many instances they are not accustomed to heavy work of any kind. It has been the exception for the city to reduce the rate of wage for this class of labour.

I am heartily in sympathy with your ideas in this matter and hope the discussion you are endeavoring to bring about will lead to actual results.

Every winter this city experiences an influx of laborers—men from outside points who are unsuccessful in their endeavor to secure work. The charity institutions are taxed severely at this season of the year, and money spent in the relief of people of this class is an economic waste.

Yours very truly,
W. P. BRERETON.
(City Engineer, Winnipeg.)

Winnipeg, October 27, 1915.

* * *

"Convince the Man Who Pays the Bill"

Editor, The Contract Record:

Ways and means of carrying out constructional operations in severe weather have received a great deal of study at our hands. Specializing as we do, our field of endeavour does not afford the same scope as that of the general contractor, and by force of necessity we have been compelled to secure winter work or be idle a large percentage of the year.

Our success in securing winter work is measured by our ability to convince the man who pays the bill that the proposed winter operations are good business from his viewpoint. This is the acid test, and a long hard fight is ahead to increase the scope of our winter work on this basis, but the results to date have been so satisfactory and encouraging that we know that we are on the right track.

It means careful study of all the factors entering into the extra cost of winter work, and by concentrated effort on these factors gradually to reduce and finally eliminate them if possible.

We will rest our case on the foregoing remarks, as it would be presumptuous to cover classes of work other than that in which we specialize.

Yours very truly,
THE FOUNDATION COMPANY, LIMITED.

Montreal, October 25, 1915.

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Winter Construction an Important Problem for Canada

Editor, The Contract Record:

Owing to the difference in climatic conditions, the question of winter construction is a much more important one in Canada than it is in the United States. I have always felt that much of our work could be so arranged that there would be far greater activity during the winter season, thus giving employment to labour when it is most needed. But even in our less severe climate I have always tried to avoid the use of concrete or any masonry construction in severely cold weather. With our shorter and less severe winters, operations can frequently be arranged so that the suspension of masonry work during severe weather does not involve serious delay, but I realize that the situation is different in Canada, and that if such work can be carried on with safety during the winter it would be most desirable to do so. As to precise methods which should be adopted, or as to the increased cost, and whether such increase would be offset in a large degree by cheaper labour and other considerations, I shall follow the discussion in your journal.

Yours truly,
NELSON P. LEWIS,
(Chief Engineer, Board of Estimate and Apportionment, New York City.)
New York City, October 25, 1915.

Insurance of Office Tenure

Editor, The Contract Record:

I have read with considerable interest in a recent issue of The Contract Record Mr. J. W. B. Blackman's letter on Security of Tenure, and also your editorial on the subject. The specimen policy published in your issue of October 6 covered many interesting points, but the scheme does not seem very practicable to me. Only the fact that such insurance is actually being carried out in Great Britain suggests the feasibility of its adoption in Canada. It must not be overlooked, however, that tenure of office is much more secure in the Old Country than in Canada.

The desirability of such an insurance is much the same as for any other insurance—namely, to provide against unforeseen contingencies. It is in the application of the scheme that difficulties seem to arise. For example, there is the problem of determining what is an arbitrary and unjust dismissal. It is quite possible that a few isolated actions, considered by themselves, might justify dismissal, whereas, if taken in their proper relation to the man's record, they might appear very trifling. It would seem necessary for the insurance company to keep a complete record of the professional career of those they insured.

In the matter of the dismissal of engineers, it should be borne in mind that it is not always the loss of position that counts so much, as the fact that public bodies, in order to justify their own actions, find it necessary to blacken the reputation of the employee. It hardly seems possible that this disagreeable factor could be eliminated by the operations of an insurance company, for it appears to be one of the risks attendant upon public office.

It is an open question whether a man should continue to accept municipal offices after he has once lost the public confidence. Of course, his downfall may have been brought about through misrepresentation on the part of influential but unscrupulous enemies—in which case he may be confident of his ability to give good service whether he be successful in winning back public support or not.

In my own opinion, further discussion of Mr. Blackman's proposal would be beneficial. Perhaps some more practical scheme could be worked out. It is possible that some modified form of assisting civic employees temporarily out of work might be devised.

Yours truly,
A. J. LATORNELL,
(City Engineer, Edmonton, Alta.)
Meaford, Ont., October 27, 1915.

Capt. Leon H. Curry, son of Senator Curry, has been killed at the front. Captain Curry, who joined the 42nd Highlanders, was thirty years of age. He was connected with the Canada Car and Foundry Company, and five years ago went from Amherst, N. S., to Montreal, when the Canadian Steel Foundries Corporation (of which Senator Curry is president) was formed. For several years he was Assistant to the Vice-President and General Manager, as well as a Director of the company. Less than two years ago he was married to Miss Marion McKeen, of Halifax.

Mainly Constructional

East and West—From Coast to Coast

Another new Montreal contracting firm is that of Valin & Bail.

Messrs. Martineau & Prenoveau, general contractors, Montreal, have registered a partnership.

Mr. James Chisholm, the veteran Winnipeg architect, is seriously ill at his winter home at Ocean Park, California. He is suffering from pneumonia.

The Standard Steel Company, Montreal, has been incorporated with a capital of $200,000. L. A. David, L. E. Mailhiot, and S. H. Bush are among the incorporators.

A report favouring the construction of an incinerator with a capacity of five hundred tons a day, and costing $200,000, has been submitted to the Montreal City Council.

The St. Catharines Steel and Metal Company, Limited, capitalized at $50,000, has been incorporated with head office at St. Catharines. The incorporators include H. Shortt and Henry Collier, of St. Catharines.

The Toronto House-Wrecking and Construction Company, Limited, is the name of a new Toronto firm capitalized at $40,000. The incorporators include A. Stein, William Fink, and Samuel Floderwasser.

The building permits issued in Vancouver recently totalled $200,000 in one week. The explanation of this is that the Dominion Government took out a permit for work valued at $195,000, this being in connection with reclamation work.

The Canadian Bridge Company, Limited, Walkerville, Ont., has obtained a Dominion charter with a capital of two million dollars. The incorporators include F. C. McMath, Willard Pope, and C. M. Gooderich, of Detroit, and A. L. Colby and C. T. Miller, of Walkerville.

Good progress is reported on the construction of the eight-storey reinforced concrete warehouse which Wells Brothers of Chicago are building at Regina for the Robert Simpson Company of Toronto. The roof is to be on early this month. The building was started some ten weeks ago.

At Port Moodie, B. C., operations have started in clearing the nine and one-half acre site upon which the plant of the Port Moodie Steel Works is to be erected. The city is to guarantee the bonds of the new industry to the extent of $100,000. It is planned to have the plant completed and in operation by the New Year.

At a meeting of the Dominion Sugar Company, of Wallaceburg, Ont., held last week, it was decided to make an immediate start on the erection of a beet-sugar factory at Chatham, Ont., at a cost of one million dollars. It is understood that the city will pass a by-law granting the company a free site worth $18,000. The factory will be situated at the west end of the city of Chatham, and will give employment in the busy season to upwards of three hundred men.

The muddle into which Montreal's paving programme has drifted, owing to various injunction proceedings, is illustrated by a statement made by Mr. P. Mercier, the acting chief engineer, regarding streets ready to be paved with asphalt macadam. He estimates that the city will lose $50,000, as the foundations of many streets, already laid, will have to be relaid in the spring. Already damage has been done to these foundations, the city being powerless to secure the asphalt owing to the injunctions issued by the Courts.

Personal Mention

Lieut. J. Cameron, of the Third Battalion, a civil and mining engineer of Toronto, is reported wounded at Etaples.

Sergeant Harry Mellor, a Toronto contractor, twenty-nine years of age, who joined the 19th Battalion, C. E. F., in the early part of the war, is reported severely wounded.

Mr. G. Preston Brady, formerly connected with Campbell & Lattimore, contractors on the foundation work for the high level bridge at St. Catharines, Ont., is now engaged in drafting work for the Pere Marquette Railroad in connection with valuation work.

Mr. G. W. Britnell, a popular member of the Toronto Builders' Exchange, has been appointed Transport Sergeant of the new Pioneer Battalion. Mr. Britnell was the Toronto representative of Queenston Quarries, Limited, Shale Products, Limited, and Sarnia Metal Products Company, Limited.

Lieut. Thos. C. Campbell, of the Royal Engineers, whose death on a hospital ship is announced, sustained severe wounds in Gallipoli. He was an engineer and was engaged on the Mount Royal tunnel of the C. N. R. Subsequently he went to Ottawa and Toronto on work in connection with the water systems of those cities.

Lieut. Herrick Duggan, of the Royal Engineers, who was wounded on October 19, has succumbed to his injuries. He was the son of Mr. G. H. Duggan, Managing Director of the Dominion Bridge Company and a prominent member of the Canadian Society of Civil Engineers. Lieut. Duggan was a graduate in engineering of McGill University, and in 1913 was engaged in the steel industry in Germany. He was given a commission in England.

The Corrosion of Metal by Plaster

By W. J. Haire

THERE is a rather wide-spread belief that Portland cement will preserve metal work from corrosion, and that gypsum will promote corrosion. Theoretically this is correct, but in practice it is found that gypsum plaster has no corrosive effect and affords protection equally as well as Portland cement. This is due to the fact that gypsum plasters as now made have a sufficient proportion of hydrated lime incorporated in the manufacture to more than neutralize any free acid in pure gypsum.

Speaking some time ago on the subject of corrosion of steel in concrete, Mr. W. H. Walker, Director of the Research Laboratory of Applied Chemistry of the Massachusetts Institute of Technology, said that every engineer is well aware of the fact that acidulated water, no matter how small the percentage of acid may be, tends to corrode steel by increasing the number of hydrogenions present. It had been made clear, from tests he carried out, that there were certain alkaline substances present in concrete which corrected any acidity, and so protected the contained metal work from corrosion.

This fact has an important bearing upon the question of whether concrete will protect iron or steel from corrosion. Inasmuch as Portland cement, when it sets or hardens, liberates a quantity of caustic lime, which is a strong alkali, the answer to the question must be in the affirmative. Iron or steel will not corrode when embedded in good concrete; but caustic lime is soluble in water, and poorly made concrete is not impervious to moisture. Therefore, if iron be embedded in concrete through which water is allowed at any time to percolate, this calcium hydrate will be slowly but surely dissolved. With it will disappear the inhibiting action of the concrete, and iron embedded therein will, in time, rust and become corroded. To ensure absolute protection of the reinforcing members of concrete construction, therefore, such concrete must be of good quality and sufficiently dense and carefully made to render it waterproof.

Mr. S. J. Webb, Secretary of the Gypsum Industries Association, New York, has investigated the subject of corrosion on metal lath by gypsum plasters, and gave the writer the following results of his investigations. Gypsum plaster to which has been added a small quantity of hydrated lime —enough to give an alkaline reaction, on test—will not corrode metal work of any kind. He maintains that it is not gypsum which corrodes or which creates corrosion, but the currents of damp air which are allowed to have access to the metal work—in other words, that where the metal work is entirely sealed from the action of the air, by having a sufficiently thick coat of plaster over and around it, there is not sufficient porosity in the ordinary wall plaster to allow damp air to reach the metal work, and therefore there will be no corrosion. He had occasion recently to cut into the floor and roof of Hammerstein's Theatre in New York, which were of gypsum construction, and had been in some nine or ten years. The floor, which was finished with one inch of Portland cement concrete, had been washed with a hose daily for years. The water had not gone through the plaster, and therefore the steel work protected by the floor was in perfect condition. He also cited another example: The National Fire Underwriters' Laboratories in Chicago had in their basement for two years a section of metal lath coated with gypsum hardwall plaster manufactured in the United States. This section had been subjected to dampness in the cellar for a sufficiently long period to give it a good test. Mr. Webb secured the section and had tests made. On removing the plaster it was found that where the metal lath had been covered with an ordinary thickness of plaster from one-quarter inch upwards there had been slight initial corrosion but no progressive corrosion. In a few places where the plaster had been skinned very thin so that there was sufficient porosity to allow the air to pass through there had been progressive corrosion. He took a portion of this section with him to New York and exhibited it before a committee who had in charge a revision of the New York building laws. The demonstration was convincing to this body, composed of eminent scientists and men prominent in the building trades, with the result that they approved of the use of gypsum plaster over all metal surfaces.

A section of wall was taken from the King Edward Hotel, Toronto, recently, which had been plastered a number of years ago with gypsum wall plaster on metal lath. The metal was very badly corroded. The plaster had been applied in a thin coat, and was manufactured at a time when the gypsum hardwall manufacturers had not begun to use hydrated lime to neutralize the slight amount of free acid in gypsum. It is due to examples of this kind, coupled with the fact that pure gypsum gives an acid reaction, that there is a prejudice against the use of hardwall plaster in connection with metal. Some metal lath manufacturers have gone to a great deal of trouble to adapt their materials for use of gypsum plasters. While we believe that any improvement in the manufacture of metal lath that will make it less liable to corrosion is a distinct advance, we find that if gypsum plaster is applied to the thickness of one-half inch or more and well trowelled to a sufficient density to make an ordinary good wall there is no danger of gypsum hardwall plaster corroding ordinary steel metal lath or other metal surfaces. It will be found that there is always present an initial corrosion, but that where ordinary care is taken there will be no progressive corrosion, and that therefore the metal will be properly protected, and also that it is immaterial whether

Portland cement plaster or a gypsum hardwall plaster is used. The ancient objection no longer obtains in regard to the use of gypsum hardwall plasters made by modern methods and formulae. A simple test can be carried out by any one to show whether there is any free acid present in the plaster. When you have your plaster mixed up, insert a strip of litmus paper in the mortar, and if it turns red you will know that there is free acid present, and the mortar should not be used on metal lath. If it turns blue, it means that the material is alkaline, and therefore suitable for metal.

The Albrecht Excavator and Loader

THE T. L. Smith Company announce that they have purchased the exclusive manufacturing and selling rights of the Albrecht excavator and loader, and that they are in a position to make prompt shipment of machines.

This means that one of the largest and oldest concrete mixer companies has entered the dirt moving field. As this company manufactures a broad line of contractors' equipment, the Albrecht excavator and loader can be handled to splendid advantage.

For over five years the inventor, John H. Albrecht, has tried to market this really wonderful machine. A number of these Albrecht excavators and loaders were sold and are being successfully used in different parts of the United States. Lack of capital, however, prevented the successful development of the business. Realizing the immense field in which this machine could be used to advantage, The T. L. Smith Company took over the entire business of the Albrecht Excavator Company. Backed by their world-wide selling organization, and with their immense resources, The T. L. Smith Company will be able to handle the ever-increasing demand for this machine.

The Albrecht excavator and loader is well described by a man prominent in engineering circles: "This machine is halfway between a hand shovel and a steam shovel, and will do the work of both." It does away with the big gang of shovellers. The wagons do not have the long, heavy pull out of the pit, and the snatch team is done away with, the loading being done on the surface. Two men only are required to operate the equipment—one man in the pit to handle the scraper, and one man to run the machine. A 12 h.p. horizontal gas engine, heavy duty type, provides ample power to dig and load 20 cubic yards an hour. This machine will dig at a distance of 100 feet from the machine, and at any desired depth for ordinary excavations at a rate of about one round trip a minute. With this loader you can plow faster than with horses, and load as fast as ten men. It will dig at any point either above or below its level, and over a big area covering almost a half circle back of the machine.

The Albrecht excavator and loader can be used for excavating, for big foundations, basements and drainage ditches, for backfilling, for loading sand, gravel and other similar materials, and it is an economical investment for the contractor who handles street and highway paving. It can be used to splendid advantage on the ordinary roadway in place of the regular horse scraper.

Additional information, prices, etc., can be secured by writing to The T. L. Smith Co., 1196-A 32nd Street, Milwaukee, Wis.

Addressing Mail to Soldiers

In order to facilitate the handling of mail at the front and to insure prompt delivery it is requested that all mail be addressed as follows:—

(a) Regimental Number.
(b) Rank.
(c) Name.
(d) Squadron, Battery or Company.
(e) Battalion, Regiment, (or other unit) Staff appointment or Department.
(f) Canadian Contingent.
(g) British Expeditionary Force.
(h) Army Post Office, London, England.

Unnecessary mention of higher formations, such as brigades and divisions, causes delay.

The Albrecht excavator and loader.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Aldborough Township, Ont.
The Township Council are considering the construction of the Schleihauf Drain. Reeve, A. McColl, West Lorne, Ont.

Keppel Township, Ont.
The Township Council have authorized the expenditure of $4,000 on repairs to the roads. Clerk, George Atkey, Oxenden, Ont.

Kingston, Ont.
The City Council will call for tenders shortly on the construction of a pavement on University Avenue. Clerk, W. W. Sands.

Leamington, Ont.
The Town Council have authorized the laying of a pavement on McGaw Street. Work will start as soon as possible.

New Glasgow, N. S.
Work has been started on the laying of a temporary 8-inch watermain by day labor. Engineer, E. S. Fraser.

Pembroke, Ont.
The Town Council are considering the construction of a macadam roadway estimated to cost $4,000. Engineer, W. J. Moore.

Sudbury, Ont.
The Town Council contemplate laying sidewalks to cost approximately $3,800. Clerk, W. J. Ross.

Tilbury, Ont.
Work will start shortly on the construction of sewers on St. Clair and Superior Streets for the Town Council. Clerk, W. A. Hutton.

Toronto, Ont.
The Board of Control will receive tenders until November 9th for asphalt paving on Condor Street and Empress Crescent, grading on Glenview Street and sidewalks on Annette and Watkinson Streets and Weston Road. Plans at office of the Works Department.

CONTRACTS AWARDED

Hamilton, Ont.
Contracts for sewer construction have been let by the City Council to J. J. Armstrong, 116 Burris Street, J. D. Armstrong, 138 Erie Avenue, and to the City Engineer.

London, Ont.
Contracts for the construction of sewers have been let to the Webster Construction Company, Ltd., Bank of Toronto Building, at $3,590, and to the Fielder Construction Company, William Street.

Prince Albert, Sask
The City Council have let the contract for the supply of material for the sewer on Ninth Avenue W. to the Ontario Sewer Pipe Company, Ltd., Mimico, Ont. Work by day labor.

Thorold, Ont.
The Town Council have let the contract for construction of sewers to Peter Domizzio, Thorold, Ont.

Toronto, Ont.
Contracts for the construction of sidewalks have been let by the Board of Control to the following firms:—Ramsay Contracting Company, 39 Indian Rd. Crescent; J. P. Nicholson, 48 Alexander Street; A. Johnson, 35 Burgess Street; Riverdale Concrete Paving Company, 256 Jones Avenue; Standard Concrete Paving Company, 74 Moscow Avenue; H. Mitchell, 464 Brock Avenue; Godson Contracting Company, Manning Chambers.

The following contract for laying pavements have been let by the Board of Control:—Works Commissioner R. C. Harris, asphalt on Bleecker, Coxwell, Elmwood and Springrove Sts., $22,046; Grant Contracting Company, $15,795; Asphaltic Concrete Company, 74 King Street E., concrete on Hanover Place and treated wood block on a lane, $4,731.

The Board of Control have let a contract to the Agnew Company, 606 Avenue Road, for the construction of sewers on Clendennan, Marie, Vine and Symington Streets, at $8,593, and to D. Arnot, foot of Berkley Street, for the construction of the McLean Avenue Outlet, at $2,440.

Railroads, Bridges and Wharves

Belleville, Ont.
The Belleville & Bay of Quinte Bridge Company, c/o E. G. Porter, M.P., are considering a large amount of concrete work on the piers of the Bay Bridge. Engineer, L. E. Allen.

Blenheim, Ont.
The Pere Marquette Railway Company propose to build a switch here. Particulars from the Superintendent, St. Thomas, Ont.

Petrolia, Ont.
The Town Council are considering the construction of a railway switch for the proposed sugar refinery. Particulars from G. S. Pitkin.

Toronto, Ont.
By-laws for the construction of a hydro-electric railway between Toronto and London will be submitted to the various Municipalities concerned on January 1st, 1916. Estimated cost, $11,000,000.

Public Buildings, Churches and Schools

Bathurst, N. B.
Tenders will be received until 4 p.m., November 11th, by R. C. Desrochers, Department of Public Works, Ottawa, for alterations and additions to the fittings at the Post Office. Plans and specifications with the Caretaker, Public Building, Bathurst, with D. H. Waterbury, St. John, N. B., and at the Department. Specifications only at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Birchcliffe, Ont.
Tenders on the erection of a school for the Trustees of School Section No. 15, Scarborough, will be received until November 8th by the Secretary, H. A. O. Grimbly, Birchcliffe. Plans at office of the Architect, William Fraser, 34 Victoria Street, Toronto. Brick construction, slate roofing. Approximate cost, $20,000.

North Portal, Sask.
All fittings required for the school now being erected for School District No. 490 will be purchased by the School Board. Chairman, F. Douglas.

Woodrow, Sask.
The Trustees of School District No. 3462 have been authorized to borrow $5,000 for the erection of a school. Secretary, Kirk Robinson, Woodrow.

CONTRACTS AWARDED

Lindsay, Ont.
In connection with fitting up the Armouries, the Department of Militia and Defence have let the general and carpentry contracts to John Carew, and the heating and plumbing to William Hungerford, Colborne Street.

Norwich, Ont.
In connection with the Library now in course of erection for the Town Council, the contract for concrete work has been let to F. Sweazy, Norwich, carpentry and painting to W. F. Bowman, Norwich, and heating and lighting work to F. C. Bishop, Main, Street. Fittings will be purchased by the Library Board.

Quebec, Que.
Work has been started on interior alterations at the convent on Ste. Therese Street for the Soeurs Franciscaines, 188 Grande Allee Street. General contractors, L. H. Peters, Ltd., 10 Ste. Angele Street. Approximate cost, $4,000.

Sault Ste. Marie, Ont.
The contract for the installation of plumbing and heating at the new gaol building has been awarded to the Ideal Plumbing & Heating Company, 144 Queen Street E., for wiring and electric fixtures to O. C. Carney, 492 Queen Street E.

Toronto, Ont.
The Board of Education have let the contract for the erection of a retaining wall at Roden School to the Ramsay Contracting Company, 39 Indian Road Crescent, and for iron fences at Earlscourt and Huron Street Schools to the British American Hardware Manufacturing Company, Patterson Place.

Business Buildings and Industrial Plants

Aylmer, Que.

Tenders are now being received for all trades required in alterations to the club house of the Ottawa Golf Club. Architects, Horwood, Taylor & Horwood, 130 Sparks Street, Ottawa.

Eureka, N. S.

The Nova Scotia Underwear Company, Ltd., have decided to rebuild their plant, which was recently destroyed by fire. Work will probably start shortly.

Fort William, Ont.

Plans have been drawn for a warehouse to be erected on Hardisty Street for the Lake of the Woods Milling Co., Cuthbertson Block. Frame and corrugated iron construction, concrete foundation. Approximate cost, $4,000.

Kippen, Ont.

Isaac Jarrott is considering alterations and improvements to his farm buildings. Work will include cement block foundations and interior changes.

Kirkton, Ont.

Wellington Neil contemplates the construction of a fireproof barn to replace that destroyed by fire. Estimated cost, $3,000.

The erection of fireproof barns is being considered by William Gilfillan. Approximate cost, $3,500.

London, Ont.

M. Noxell, 200 West Street, has commenced the erection of a store and residence on Trafalgar Street, estimated to cost $3,000. Concrete block construction, concrete foundation, felt and gravel roofing. Smaller trades will be let.

H. T. Reason, 180 York Street, contemplates the erection of a factory for the manufacture of paper boxes. Work will probably shart shortly.

Montreal, Que.

A. Depetro, 1232c Cadieux Street, has commenced the erection of a store and flats on Berri, Rolette and Isabeau Sts., estimated to cost $5,500.

Tenders on the erection of an addition to the pump house on Papineau Avenue are being received by the Waterworks Engineer, T. Lesage, City Hall. Reinforced concrete construction, brick facing, felt and gravel roofing.

Ottawa, Ont.

In connection with the stores built on Bank Street for W. H. Lister et al., the owners have decided not to instal a heating system at present.

Petrolia, Ont.

The Town Council are having plans prepared for a transformer station, estimated to cost $5,000. Clerk, J. McHattie.

Preston, Ont.

The Solid Leather Shoe Company, Queen Street, contemplate the erection of an addition to their factory at an early date. Manager, J. Parker.

Salisbury, N. B.

Eben Lewis has commenced the erection of a saw and shingle mill, and is in the market for equipment.

Sarnia, Ont.

S. Scarlatta, 165 Lochiel Street, is about to start work on the erection of a store and warehouse on Market Square.

Stanstead, Que.

James Daly is considering the rebuilding of his barn and residence at an approximate cost of $3,500.

Strathroy, Ont.

D. A. Patterson contemplates the remodelling of his store and the installation of fittings and equipment. Work will start shortly.

Thedford, Ont.

G. Heming is about to remodel and equip premises as an auto wareroom and repair shop.

Toronto, Ont.

The Board of Control ill receive tenders until November 9th for the erection of buildings at the Don Roadway Incinerator. Plans at office of the City Architect, City Hall.

Work has been started by C. Hough, 16 Atlas Avenue, on the erection of a store and residence at Broadview and Browning Avenues. Smaller trades will be let. Brick construction, felt and gravel roofing. Approximate cost, $3,500.

Victoria Harbour, Ont.

Work is about to start on the erection of a business block for James Burnie under the supervision of Albert Long, Victoria Harbour.

Westmount, Que.

Saxe & Archibald, 314 Dorchester St., are preparing plans for a residence and two garages to be built for C. H. and N. A. Timmins, 4 Park Crescent. Tenders will be called shortly. Brick construction, concrete foundation, slate roofing. Estimated cost, $8,000.

Windsor, Ont.

Plans are being prepared for a store front and other alterations to premises on Sandwich Street W. for the Canadian Pacific Railway Company, c/o E. C. Rice, 57 Church Street. Architect, W. Walker, 43 Jeanette Avenue. Approximate cost, $3,200.

CONTRACTS AWARDED

Blenheim, Ont.

Work has been started on the erection of a rink for the Blenheim Skating Rink Company. The masonry contract has been let to D. Gray, the carpentry to John Henderson, and steel and roofing to W. D. Samson. Approximate cost, $3,500.

Cornwall, Ont.

Anglins Ltd., 65 Victoria Street, Montreal, have commenced the erection of a storage warehouse for Canadian Cotton's Ltd., 28 Victoria Square, Montreal. Mill and brick construction, concrete foundation. Estimated cost, $50,000.

Fort William, Ont.

D. A. Gordon, Luci Court, has commenced the erection of an addition to the warehouse of the Dwyer Elevator Company, Ltd., Island No. 2. Frame and corrugated iron construction and roofing, concrete foundation. Estimated cost, $4,000.

Hamilton, Ont.

In connection with the addition now being erected at the premises of Arcade Ltd., James Street N., the contract for heating and plumbing has been let to R. H. Dow, 15 Bay Street N., and electrical work to T. Murphy, 241 Robert Street. Tenders are now being received for roofing.

Kingston, Ont.

The following contracts have been let in connection with the factory in course of erection at Rideau and Cataraqui Sts. for Susman & Cohen, 292 Ontario St.:—heating, Simmons Bros., 132 Princess Street; vault door, J. & J. Taylor Safe Company, 145 Front Street, Toronto; freight elevator, Roelofson Elevator Company, First Avenue, Galt; carpentry, Kingston Construction Company, Kingston.

Montreal, Que.

Work has been started on the erection of an addition to the factory at 980 Craig Street E. for the Canadian Consolidated Rubber Company, 950 Notre Dame Street E. The general contract has been let to G. M. Martin & Company, 399 Decarie Boulevard. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Murray Bay, Que.

The general contract for repairs to the Manoir Richelieu for the Canada Steamship Lines, Ltd., Victoria Square, Montreal, has been awarded to D. H. Scott, 155 Vendome Avenue, Montreal.

Ottawa, Ont.

In connection with the garage to be erected for T. D. McFarlane, Bank St., the contract for galvanized iron work and roofing has been awarded to McFarlane & Douglas, 250 Slater Street, the painting to W. J. Carson, 293 Laurier Street W., and the electrical work to Marchant & Donnelly, 128½ Sparks St.

The general contract for the erection of four stores at Bank and Sunnyside Streets for Graham Bros., 205 Laurier Avenue, has been awarded to Shuttleworth & Black, 24 Euclid Avenue. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000.

Theodore Landrey, 315 Rideau Street, has let the general contract for the erection of a garage to Monette & Groteau. Approximate cost, $6,000.

Quebec, Que.

In connection with the garage being built for Gaspard Lemoine, 183 Grand Allee Street, the contract for masonry has been let to Emile Cote, 358 Richelieu Street. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

Sherbrooke, Que.

The general contract for the erection of a machine shop for the Canadian Ingersoll Rand Company has been awarded to Anglins Ltd., 65 Victoria Street, Montreal, and the contract for steel work to Dominion Bridge Company, Lachine, Que. Rough lumber will be supplied by Tobin Manufacturing Company, Bromptonville, Que., and finished lumber by L. O. Noel, Lennoxville Road. Approximate cost, $50,000.

Toronto, Ont.

E. G. Powell, 28 Bayview Avenue, has commenced the erection of an undertaking parlor and residence for W. W. Deavitt, 1721 Bloor Street W. Brick construction, felt and gravel roofing. Estimated cost, $5,000.

The general contract for the erection of an addition to the factory at 26 Alpine Avenue for R. J. Henderson, Lumsden Building, has been let to R. H. Harman & Son, 248 Dupont Street. Brick construction, tar and gravel roofing. Estimated cost, $3,500.

Wardsville, Ont.
Work has been started on the erection of a store for C. G. Knapton, estimated to cost $3,000. General contractor, B. Miller. Frame construction, shingle roofing.

Woodstock, Ont.
The general contract for the erection of an addition to the machine shop of W. Baird & Son, Dundas Street, has been awarded to J. D. Tindall & Son, Adelaide Street. Brick construction, concrete foundation, Paroid roofing. Approximate cost, $4,000.

Residences

Alvinston, Ont.
Henry White has started work on repairs to his residence. Frame construction.

Work has been started by John Cummings on remodelling his residences.

Exeter, Ont.
J. E. Elliott, West Ward, has commenced the erection of a residence, estimated to cost $3,000. White brick construction, concrete foundation, shingle roofing.

Huckleberry Island, Ont.
Plans have been prepared by Frank T. Lent, Gananoque, Ont., for a residence to be erected for F. T. Becker, New York City. Tenders will not be called. Frame and shingle construction. Approximate cost, $3,100.

London, Ont.
The erection of a residence is contemplated by William Gray, 133 Langarth Street. Approximate cost, $3,500. Work may not start until next spring.

Maisonneuve, Que.
J. T. Legault, 361 LaSalle Street, is considering the erection of a residence to cost about $7,000. Limestone construction, concrete foundation, felt and gravel roofing.

Middlemiss, Ont.
A. Battin, Middlemiss, Ont., is considering the erection of a residence to replace that destroyed by fire. Estimated cost, $3,000.

Montreal, Que.
Work by day labor has been started on alterations to a residence on Sherbrooke Street West for F. L. Beique, 340 Sherbrooke Street West. Material has been provided. Approximate cost, $12,000.

Norman King, 213 Madison Avenue, has commenced the erection of two flats on Harvard Street. Brick construction, felt and gravel roofing. Estimated cost, $10,000.

Work has been started by N. St. Armand, Lac aux Sable, Portneuf County, on the erection of a residence on LaSalle Avenue. Frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

N. Lamarre, 194 Knox Street, is building three flats on Hall Street, estimated to cost $3,000. Brick construction, concrete foundation, felt and gravel roofing.

Mount Dennis, Ont.
The Baskerville Building Company, Mount Dennis, have commenced the erection of a residence on Rutherford Avenue, estimated to cost $3,000. Brick construction.

Outremont, Que.
Work has been started by H. Candlish, Apartment 1, 1080 Van Horne Ave., on the erection of a residence on Wilder Avenue. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $8,000.

Port Dover, Ont.
J. Eyers, Port Dover, is considering the erection of a residence to cost approximately $3,000. White brick construction.

The erection of two residences on St. Andrews Street is being considered by E. Nicholls, Dominion Hotel. Approximate cost, $5,000.

Port Franks, Ont.
Charles McGordic, Forest, Ont., has commenced the erection of a number of log bungalows, estimated to cost $3,500.

Quebec, Que.
W. Morel, 191½ Commissioners St., has commenced the erection of a residence on Canardiere Road, estimated to cost $4,000. Frame and brick construction, concrete foundation, asbestos roofing.

Stanstead, Que.
The following residents have decided to rebuild their houses, which were destroyed in the recent fire:—Mrs. L. A. Hastings, Mrs. Vesina, F. Belanger, E. E. Charland, G. W. Hall, J. Heath, J. Williamson.

Thorold, Ont.
Crompton & Crompton, Front Street, are considering the erection of a number of workmen's houses.

Toronto, Ont.
G. F. Cudmore, 6 Pacific Avenue, has commenced the erection of two residences on Clendennan Avenue, estimated to cost $4,200. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started by W. H. Avison, 573 Indian Road, on the erection of a residence at 41 Mountview Avenue. Brick construction, shingle, felt and gravel roofing. Smaller trades will be let.

Coxwell & Galloway, 99 Gladstone Avenue, have commenced the erection of a pair of residences on Sellers Street. Brick construction, stone foundation. Approximate cost, $5,000.

Work has been started by J. Thorne, 27 Woodbine Avenue, on the erection of two residences on Brookside Drive. Brick construction, shingle roofing. Approximate cost, $4,000. Smaller trades will be let.

F. R. Fry, 116 Runnymede Avenue, has commenced the erection of a residence at 103 Durie Avenue, estimated to cost $3,500. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started by G. E. Case, 56 Oakwood Avenue, on the erection of three residences on Glenholme Avenue, estimated to cost $9,000. Brick construction, shingle roofing.

J. McCandlish, 208 Lauder Avenue, has started work on the erection of a residence at 204 Lauder Avenue. Brick construction, stone foundation. Approximate cost, $3,000.

R. J. Colf, 17 Northcliffe Boulevard, has commenced the erection of a pair of residences on Mount Royal Avenue, estimated to cost $5,000. Smaller trades will be let. Brick construction, shingle, felt and gravel roofing.

A. J. Peppiatt, 12 Wells Hill Avenue, is building four residences on Keewatin Street. Brick construction, shingle roofing. Approximate total cost, $19,000.

Work has been started by J. A. Thomas, 976 Logan Avenue, on the erection of two pairs of residences on East Lynne Avenue. Smaller trades will be let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $7,200.

William Oliver, 153 Erskine Avenue, has commenced the erection of a residence on Keewatin Avenue, estimated to cost $4,000. Brick construction, shingle roofing. Smaller trades will be let.

J. McCurrah, 100 Westminster Avenue, has commenced the erection of a residence on Columbine Avenue, estimated to cost $3,000. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started by J. A. Powell, 139 Browning Avenue, on the erection of a pair of residences on Gillard Street. Brick construction, shingle roofing. Estimated cost, $5,000.

The erection of a residence at 28 Hutchinson Avenue has been commenced by S. B. Green, 650 Annette Street. Smaller trades will be let. Brick construction, stone foundation, slate roofing. Estimated cost, $4,000. .

J. R. Gifford, 195 Browning Avenue, has commenced the erection of a pair of residences on Gillard Street, estimated to cost $4,500. Brick construction, shingle roofing.

Windsor, Ont.
J. E. Wescott, 55 Oak Avenue, has commenced the erection of a residence estimated to cost $3,500. Frame and stone construction, brick construction foundation, shingle roofing.

CONTRACTS AWARDED

Charlottetown, P.E.I.
In connection with the residence built for Russell White, Brighton Street, the contract for plumbing and electrical work has been let to H. & S. Lowe, 238 Hillsboro Street, and the heating to Bruce Stewart & Company.

Hamilton, Ont.
M. Allen, care of Sawyer-Massey Company, Wellington Street North, has let the general and carpentry contracts for the erection of a residence at 120 Fairleigh Street to T. P. Sullivan, 203 Hunter Street East, and the masonry contract to Isbister Bros., Emerald Et. S. Brick construction, stone foundation, shingle roofing. Estimated cost, $4,000.

Plans have been prepared for a residence to be erected on Holton Avenue S. for S. H. Kent, 84 Grant Avenue. The general, carpentry and roofing contracts have been let to C. H. Hudson, 10 Edinburgh Street, the masonry contract to Clingbeale & Jevons, 59 Tisdale Street N., and heating and plumbing to H.

Barnes, 23 Fife Street. Brick construction, stone foundation, shingle roofing. Approximate cost, $3,000.

Lachine, Que.
A. Decosk, 117 Sixteenth Avenue, has commenced the erection of a residence on 44th Avenue for Adelard Martin, 393 St. Joseph Street. Brick construction, concrete foundation. Approximate cost, $5,000.

Maisonneuve, Que.
The general contract for the erection of a residence for E. Sauvageau, 2 Adam Street, has been let to Charles Martin, 2 Adam Street.

The general contract for the erection of a brick residence on Desjardins St. for J. A. Gagnier, 325 LaSalle Avenue, has been let to J. Durand, 944 Desjardins Street. Estimated cost, $7,000.

Montreal, Que.
The following contracts have been let in connection with the erection of a residence on Rosedale Street for G. D. Blackbird, 198 Beaconsfield Street:—general, masonry and carpentry, Kensington Building & Construction Company, 296 Madison Avenue; roofing, J. Dunphy, 55 Barrie Street; plastering, Z. Bouchard, 12 Bourget Etreet; painting, Martin & Montgomery, 556 Madison Avenue; electric wiring, G. F. Porteous, 1009 Dorchester Street W.; heating and plumbing by owner.

Newmarket, Ont.
The contract for heating and plumbing in connection with the residence which has been built on Yonge Street for Hedley Shaw, 545 Jarvis Street, Toronto, has been awarded to Purdy, Mansell Limited, 63 Albert Street, Toronto.

Ottawa, Ont.
In connection with the residence in course of erection on Fairbairn Street for the Oakland Land Company, 1111 Bank Street, the contract for concrete work has been let to W. Smith, Westboro, the carpentry to W. Fryer, 5 Glen Avenue, and plumbing to J. D. Gervin, Bank and Sunnyside Streets. Other work not yet awarded.

H. P. Beck, 126 Sparks Street, has let the contract for heating, plumbing and gas installation at the residence in course of erection on Woodlawn Street to J. T. Blythe, Frank Street, and electrical work to Marchand & Donnelly, 128½ Sparks Street. Owner will do painting.

In connection with the residence being built on Sherbrook Street for J. W. Foster, 11 Irving Avenue, the contract for plastering has been awarded to H. Lethbridge, First Avenue, and plumbing to J. Lethbridge, care of owner.

The general contract for the erection of a residence on College Street for Mrs. Annie Johnstone, 134 Augusta St., has been let to John Johnstone,, 134 Augusta Street. Approximate cost, $5,000.

Peterborough, Ont.
In connection with the residence erected at Homewood and Belmont Streets for A. W. Cressman, 212 Brock Street, the contract for painting has been let to Embury & Howell, Peterborough. Electrical work not yet awarded.

Pointe Claire, Que.
The contract for roofing, plumbing and heating at the residence which has been erected for G. H. Napier, 20 St. Nicholas Street, Montreal, has been let to the Westmount Plumbing & Heating Company, 4278 St. Catherine Street, Westmount.

Quebec, Que.
L. P. Filion, 413 Third Avenue, Limoilou, has commenced the erection of a residence, estimated to cost $4,000, and has let the contract for carpentry to P. Gravel, 179½ King Street. Frame and brick construction, concrete foundation, asbestos roofing.

Toronto, Ont.
Work has been started on the erection of a pair of residences on Glengrove Street E. for R. Dack, 73 King Street W. The contract for masonry work has been let to Elgie & Page, 18 Toronto Street. Brick construction, shingle roofing. Estimated cost, $8,000.

Windsor, Ont.
Work has been started on the erection of three residences for George K. Kerr, Jeanette Avenue. The general contract has been let to Samuel Keyser, 92 May Street. Frame, stucco and brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000 each.

Windsor, Ont.
The general contract for the erection of a residence on Pierre Street for D. Tourd, 68 Parent Avenue, has been awarded to the Windsor East End Building Company. Brick construction, concrete foundation, shingle roofing. Estimated cost, $5,500.

Power Plants, Electricity and Telephones

Doon, Ont.
The installation of a hydro electric lighting system mentioned in our last issue has been completed.

Essex, Ont.
The Town Council have appointed a Committee to investigate the cost of installing a hydro electric system. Clerk, R. R. Brett.

Mair, Sask.
The Mair Rural Telephone Company have been authorized to borrow $2,400 for the construction of their system. Secretary, John C. Clark, Mair.

The Pas, Man.
A by-law will be submitted to the ratepayers in December providing for the installation of a telephone system at an approximate cost of $12,000. Town Clerk, H. H. Elliott.

Fires

Belgrave, Ont.
The grist mill owned by G. Jordon has been completely destroyed by fire. The loss is partly covered by insurance.

Berlin, Ont.
Fire has destroyed the garage owned by the Overland Motor Company. Loss, about $3,000, covered by insurance. Manager, S. O. Schmidt.

Brighton, Ont.
Fire has totally destroyed the residence of H. E. Spafford, near this town. Loss is covered by insurance.

Britannia Bay, Ont.
The double residence owned by W. W. Wylyie, 190 Carling Avenue, Ottawa, has been entirely destroyed by fire. Loss, $4,000.

Collingwood, N. S.
The residence of R. W. Farnell has been completely destroyed by fire.

Dain City, Ont.
Fire has destroyed a residence owned by John Leach, Welland Junction, Ont. Owner will replace with a brick veneer structure.

Dover Centre, Ont.
Fire has entirely destroyed the store and hall building owned by F. Watterworth.

Lakefield, Ont.
Fire has destroyed a barn owned by John Murphy, Peterborough Road, near this place. Loss is partly insured.

Listowel, Ont.
Fire has destroyed the ice house belonging to John Keeso. Loss is partially insured.

Muncey, Ont.
Fire has completely destroyed two barns owned by James R. Price. Loss, $3,000, covered by insurance.

Ottawa, Ont.
The store and residence owned by A. Pokalskiu, 345 Rochester Street, have been entirely destroyed by fire. Loss, $3,000.

Peterborough, Ont.
The mattress factory owned by James Ellis and Bruce Quinn, 3 Hunter Street E., has been destroyed by fire. Loss, $5,000.

Pickering, Ont.
A barn on the 7th Concession, Pickering Township, owned by Tilman Nighswander, has been totally destroyed by fire. Loss, $6,000, partially insured.

Seal Cover, N.B.
John Baker's store and residence have been entirely destroyed by fire. Loss, $5,000, partially covered by insurance.

Sleeman, Ont.
Fire has totally destroyed the barn owned by A. J. Hunter. Insurance small.

St. Foye, Que.
Fire has totally destroyeyd the residence of S. Sleeth. Loss is partly covered by insurance.

St. Lambert, Que.
The bakery of W. T. Simms, 115 Victoria Avenue, has been destroyed by fire. Owner will rebuild.

Strathroy, Ont.
Fire has completely destroyed two barns, the property of William Price. Loss, $5,000.

Toronto, Ont.
Fire has extensively damaged the building at 181 Yonge Street, occupied by the Imperial Candy Company; J. Ahlgren and Dr. Bass. Loss on building, $5,000.

Trent River, Ont.
Fire has destroyed a barn belonging to George McConnel.

Uxbridge, Ont.
Fire has completely destroyed the resi-

(Continued on page 50)

Tenders and For Sale Department

Tenders for Incinerator Building, etc.

Bulk tenders only, for all trades required in connection with the erection of an incinerator building, bridges, etc., on the Don. Roadway, will be received by registered post only addressed to the undersigned, up to noon on **Tuesday, November 9th, 1915.**

Plans and specifications may be seen and form of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering as prescribed by the City By-laws must be strictly complied with or tenders may not be entertained. Tenderers shall submit with their tender the names of two personal sureties, or the bond of a Guarantee Company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman Board of Control.

44

Sealed tenders addressed to the undersigned, and endorsed "Tender for Steel Gates for Regulating Dam, French River, Ont.," will be received at this office until 4 p.m., on **Wednesday, November 10, 1915**, for the construction of Steel Gates, Towers and Operating Machinery for the Regulating Dam, Big Chaudiere Falls, French River, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. Desrochers,
Secretary.

Department of Public Works,
Ottawa, October 19, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—84783. 43-44

DRUMMONDVILLE, QUE.

Capitalists Builders

To accommodate large increase in local population (200) two hundred dwelling houses are immediately required. Splendid investment, rents running from $20 to $30 per month. To induce immediate building, plans and specifications for houses will be furnished free on application to

W. A. MOISAN,
Town Clerk.

43-45

OSHAWA, ONT.

Town Engineer

Applications will be received up to November 20, 1915, by the Town Clerk, for the position of Town Engineer and Superintendent of Waterworks. Letters must state full particulars of professional experience, age, salary required, etc.

W. E. N. SINCLAIR, B.A., LL.B.,
Mayor.
THOS. MORRIS, Town Clerk. 44-45

Late News Items

Elmira, Ont.
Fire has entirely destroyed a barn owned by Solomon Rice. Loss, $9,000. Owner intends to rebuild.

Ottawa, Ont.
Work has been started by S. Cohen, Russel Avenue, on the erection of a store and apartments at Somerset Street and Russell Avenue. The contract for brick work has been let to A. Larabie, 86 St. Patrick Street. Approximate cost, $6,500. Brick veneer construction, concrete foundation, felt and gravel roofing.

Quebec, Que. ... ...
Work has been started on the erection of an annex at the St. Charles Street School for the Roman Catholic School Board. The general contract has been let to Jichereau & Lamonde, c/o J. S. Bergeon, 103 St. John Street. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

Victor Plamondon, 1235 St. Valier Street, has commenced the erection of a residence estimated to cost $5,000. Brick construction, concrete foundation, metal and asbestos roofing.

Sherbrooke, Que.
In connection with the office building which has been erected for the Bell Telephone Company of Canada, 118 Notre Dame Street W., Montreal, the contract for painting has been let to the general contractors, Anglins Ltd., 65 Victoria Street, Montreal.

Toronto, Ont.
Witchall & Son, 156 St. Helens Avenue, are receiving sub-tenders on all work required in the erection of buildings at the Don Roadway Incinerator.

Windsor, Ont.
Work by day labor has been started on the erection of an apartment on Ouellette Avenue for Mrs. Johanna O'Shea, 39½ Glengarry Street. Brick veneer construction, concrete block foundation, shingle roofing. Estimated cost, $10,000.

Tenders will be received until November 10th for alterations and additions to the Dougal Block, Sandwich Street, for Simmon Meretsky, Mercer Street. Architect, J. C. Pennington, La Belle Building. Estimated cost, $10,000.

Compressed Air Cleans Concrete Road Base Before Oiling

On certain parts of the California highway system it has been found that before the surfacing oil could be applied sufficient dust had formed on the concrete base to interfere with the proper bonding of the oil. After some experimenting a compressed-air apparatus was improvised which satisfactorily removes all dust and loose particles on the surface, it is stated, without requiring any extra trips over the road.

The device consists of a small air compartment mounted on the oil truck itself and geared to its main driving shaft. From the pump compressed air is conveyed to a 1¼-in. pipe fixed horizontally about 2 ft. above the road surface and 2 ft. ahead of the oil spreaders. This pipe is perforated by 1/32-in. holes spaced 1¾ in. apart. The air is delivered at a pressure of about 30 lb. per square inch and is said to drive off a continual cloud of dust even when working over a surface on which ordinary inspection shows no appreciable quantity of dust particles.

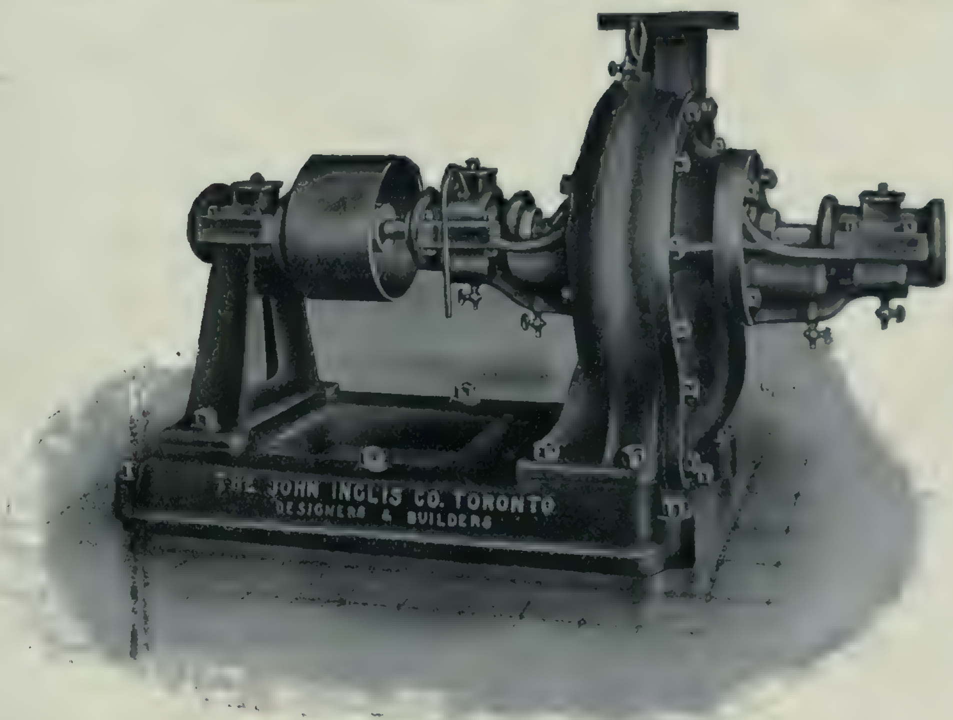
Field Testing Machine Used on Welland Ship Canal

In the construction of the concrete structures of the Welland Ship Canal it is required that field samples be taken during the progress of the work, formed into specimen beams, 4¾ in. wide, 3½ in. high and 3 ft. long, to be tested at specified ages. This work is done in the field office of each section where there is important concrete construction. Accordingly a cheap but satisfactory testing machine has been designed and is now in use.

The load is applied by means of shot poured into the can on the end of the arm. The pouring can is placed on a suitable stand and the gate opened. A string passes to the hook on which the loading can is hung so that when the concrete beam breaks the fall of the arm will close the gate. The spring on the end of the gate arm prevents the pouring can being thrown from its support. The breaking load of the concrete beam can then be read directly by means of the stress gage shown. The pouring can is made of No. 20 B. W. G. galvanized iron, is 7 in. in diameter, and has a sloping bottom so that there is no dead space.

The outfit was designed by Frank E. Sterns, designing engineer, under the direction of J. L. Weller, engineer-in-charge, Welland Ship Canal.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

INGLIS' PRODUCTS ARE "MADE IN CANADA"

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The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Ottawa Representative:—J. W. ANDERSON, 7 Bank Street Chambers

Fires

(Continued from page 47)

dence of Charles Gourlie, Fifth Concession. The loss is partly insured.

Wellington, Ont.
The evaporator belonging to L. K. Shourds has been entirely destroyed by fire.

Miscellaneous

Cardinal, Ont.
The Canadian Starch Company's electric generator has exploded and partially destroyed the building in which it was housed.

Kingston, Ont.
The City Council are considering the purchase of a combination motor driven pump, chemical and hose car. Clerk, W. W. Sands.

The City Council will receive tenders until November 5th for the supply of one combination concrete and asphalt mixer. Engineer, R. J. McClelland.

Lavallee Township, Ont.
The Municipal Council are considering the purchase of a road grader, and desire prices, catalogues, etc. Clerk, Arthur Cooke, Devlin, Ont.

Leamington, Ont.
The Water Committee of the Town Council are preparing a report on the installation of steam boilers at the waterworks. Chairman, Councillor Swatman.

Norwich, Ont.
H. R. Vigar, Contractor, Norwich, desides prices and other information with regard to steel, metal wall plugs, iron coal doors.

Ottawa, Ont.
The City Council will call for tenders about the end of January next for the supply of catch basin covers. Approximate expenditure, $10,000. Engineer, F. C. Askwith.

Preston, Ont.
The local I. O. F. Lodge have secured premises which will be equipped as lodge rooms. Particulars from W. J. Schleuter.

Revelstoke, B.C.
The City Council have decided to call for tenders on the supply of 500 feet of fire hose and a quantity of wire for street lighting purposes. Clerk, W. A. Gordon.

Toronto, Ont.
The Board of Control will receive tenders until November 9th for the supply and erection of valves, steam piping, special steel castings and logging at the Main Pumping Station. Specifications at office of the Works Department, City Hall.

CONTRACTS AWARDED

Sarnia Township, Ont.
Charles E. Foster, Sarnia, has let the contract for drilling ten wells to David Wright, Petrolia, Ont. Owner intends to drill fifteen other wells.

Trail, B.C.
The Consolidated Mining & Smelting Company have awarded a contract for the supply of several electric travelling cranes to the Northern Crane Works, Limited, Walkerville, Ont.

Proposes Definition of the Word "Vitrified"

Dean Edward Orton, Jr., of the college or engineering of Ohio State University, in a paper entitled "The Legal Interpretation of the Word 'Vitrified' as Applied to Ceramic Products," presented at the annual meeting of the American Society for Testing Materials, proposed the following definition:

"Where the word 'vitrified' is used in a contract or agreement in describing the properties of a clay product, and is not further defined in the contract, it shall mean that the product shall have attained in the firing process such a degree of compactness that its mean absorption does not exceed 3 per cent. of its own initial weight of pure water, when subjected to complete immersion in cold water for 48 hours or boiling water for 3 hours. Not less than three tests shall be made in determining the mean absorption, and no single test may exceed the mean by more than 0.5 per cent. Neither the possession of the visual properties or appearance of a glass, nor any definite degree of physical strength, hardness, color, or specific gravity shall be implied as an attribute of vitrification."

This definition was referred to the committees on clay products for conference and recommendation, with especial reference to its use in all specifications which contain no definition of the term.

In justification of this definition, Dean Orton stated that color, texture, hardness, strength and specific gravity are all affected in the heat treatment of clay, and that all may to some extent act as rough gauges or modes of measuring the progress of vitrification. Color goes through a progressive series of changes, the texture becomes finer and closer, the hardness, the strength and the specific gravity all increase, but exact measures of color, texture, hardness, strength or specific gravity are all impossible or costly, and cannot be correlated exactly with the progress of vitrification. On the other hand it appears that compactness is the one property which most clearly typifies the vitrification process, and that the absorption test makes an excellent and easily applied method of determining it. The absolute degree of compactness of a product is indicated by a single test. By a series of determinations made upon test pieces drawn at different temperatures, the progress of the vitrification process in a burn can be studied well by this simple method.

A test has been conducted by the mechanical engineering department of Purdue University, Lafayette, Ind., to determine the effect of the impact resulting from flat wheels. These tests covered flat spots of various sizes on wheels carrying definite loads and running at definite speeds. It was found that an imperfect wheel with a 3-in. flat spot struck the track with an impact of 104,000 lbs. when the car was going 16 miles an hour and carrying a load of 20,000 lbs. It was also found that under similar conditions a flat spot only 1½-in. in length produced a blow of 20,000 lbs., and the impact for spots 2-in. long was 25,000 lbs. A standard goods car was mounted in the test laboratory and special apparatus including an instrument which photographed the magnitude of the blows, was employed to collect test data.

The use of cement as an anti-sand blast is possibly one that is little known. The sand blast in question, however, is not that which is so familiar to all of us, but is quite of another type. When locomotives stand under steel or iron bridges or viaducts, the blast from the stacks throws out gases and numerous small particles of ashes and coal. This when continuously projected against the overhead iron or steel gradually causes its disintegration. In such cases cement has been successfully used, and now it is common practice for railroads to cover the bottoms of their bridges with wire netting or metal lath covered with a coating of sand and cement which it has been found resists the attack of gases and also the sand blast coming from the locomotives.

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For Contractors
Sizes 3/4, 1, 2 and 3 inches and dust.
Apply to—
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McGill University.
MONTREAL

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A few dollars spent in advertising your proposals in
The Contract Record
would result in additional competition, which might save your city or town or your client many hundreds of dollars.

ESTABLISHED 1886

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The Montreal Aqueduct

MR. Cote, Controller, of Montreal, has emphatically declined to endorse the proposal of the Canadian Society of Civil Engineers for the appointment of an independent board of engineers to report on the enlargement of the aqueduct and the installation of a hydro-electric plant. In an inspired interview, he defends the plans, and declares that they will be carried out, in spite of the strong criticism to which they have been subjected. Mr. Cote's statements are of the vaguest possible character, devoid of any figures to rebut those adduced by members of the Canadian Society, and of no value from an engineering point of view. It is unfortunate that a man without technical training should be at the head of the civic public works department, and should thus be in a position to decide matters involving engineering questions and millions of dollars.

Many competent engineers are of opinion that the hydro-electric feature of the scheme will not develop the 10,000 horse power promised and that the outlay will be excessive both as regards capital cost per unit and maintenance charges. To this Mr. Cote replies "to the best of my knowledge and belief there is not the slightest grounds for apprehension. Not only will the completed aqueduct supply the 10,000 horse power, but I am convinced the cost per unit of horse power will be remarkably low." Mr. Cote's "knowledge and belief" are not of any value from the technical standpoint, and are poor foundations on which to base the expenditure of vast and unknown amounts of the ratepayers' money. The Council of the Canadian Society of Civil Engineers want something better than this, and therefore ask for a board of experts which will examine into the entire scheme.

Mr. Cote tells us that he "has gone carefully into the plans with the aid of competent engineers, and that it would be folly to employ engineers now to go over them again and run the risk of having them pulled to pieces."

It is true that engineers have reported from time to time on parts of the plan, but there is no engineer of reputation who has reported on the scheme as it now stands, and engineers who were formerly quoted by Mr. Cote in support of the project deny that they are in favor of the scheme. Mr. Cote feels that there is a possibility of the project being "pulled to pieces" —and the Council of the Canadian Society will probably agree with him in that regard. It will be a wiser course to alter the scheme now and to evolve a practical plan than to spend millions on work which will be a great annual burden on the people of Montreal.

It is suggested by Mr. Cote that generating electric power will put the city in a position to fight any possible combination of the power and lighting companies, and a consequent raising of prices for civic lighting. The proposed outlay, however, promises to be so extravagant that it will cost the city many times the present contract price for lighting the streets, and even in the event of a fusion of the companies, it is improbable that the cost would be raised to anything like the figures which electrical engineers estimate will have to be paid under the civic hydro-electric plan. The reckless expenditure of the Montreal Council in the past does not encourage the belief that the proposal backed by Mr. Cote will be economical either in construction or maintenance.

Growing Appreciation of the Rights of Contractors

EVEN in the presence of such discouraging conditions as scarcity of work and low contract prices the contractor must find considerable consolation in the evident fact that his rights are becoming better appreciated. The way engineers and engineering journals have been speaking up for the contractor in the last few months must make that long-suffering and good-natured citizen recall the old-time revival meetings wherein penitent sinners clamored for the floor long enough to confess their sins of omission and commission. Verily, the contractor appears to be having his inning. As an old friend of his we extend our congratulations. For ten years we have bespoken a fair deal for the contractor and have urged the recognition of his rights when that subject was less popular than it seems to be at the present time. Allies are welcome, of course, no matter how tardy their arrival.

The point at which the contractor has so far made his greatest gain is in the greater reasonableness and liberality in the interpretation of engineers' specifications which is now apparent. Only the "younger" engineers now err in the slavish adherence to the letter of specifications when such adherence works a hardship to the contractor without promoting the interest of the engineer's client. The polite term "younger," as here employed, includes those young in years, those young in experience, and those with imperfectly formed conceptions of the fitness of things generally. They are being lambasted into line by their "elders." At this point substantial relief has been experienced.

However, the irresponsible low bidder is still with us. Such bidders are born every minute and while their careers are short, as individuals, their ranks are always recruited up to full strength. Such bidders flourish, for their brief moment, because city officials think it smart to award the contract to the lowest bidder, regardless of how low his bid and how modest his demonstrated abilities. It is at this point that the engineer can be of the greatest service to the contractor. While it is not the engineer's function to serve the contractor, he certainly should do so when by so doing he also serves his client. As long as contracts are awarded to irresponsible low bidders responsible bids will be forced down to a dangerously low point. That this matter is better ordered abroad is shown by the following quotation from a recent address by a British engineer who has been engaged in engineering work in this country for the past five years:

> As business conditions settle down in the west I hope to see the engineers grading contractors according to their records. To be a good contractor does not mean that a man must be a big contractor. There are jobs for all grades, the usual rough line of division being that of financial ability to carry out works of a certain size. I am more familiar with British practice in this respect, and it is quite the usual thing for an engineer to keep lists of reliable contractors, graded according to the size of job they can handle. The small men are not asked to tender on big jobs, nor are the big men asked to tender on small jobs. I should like to see engineers here in a position strong enough to enable them to say, when a tender which is obviously too low is submitted by a man or firm of consistently bad reputation, that his bid should not be considered. Unfortunately, in the rather peculiar state of business morality here such action by an engineer would almost certainly lead to his being accused of wanting the work to go to some favorite of his own.

The lack of strength mentioned comes only from a lack of unity of purpose. Let engineers agree to discourage the awarding of contracts to irresponsible bidders and the much needed reform in this particular will speedily be effected. Engineers know, if city officials do not, that it is anything but good business to award a contract at a price which makes a legitimate profit to the contractor an impossibility. Possessed of this knowledge engineers are not justified in remaining merely silent and sympathetic observers while the stage is being set for such a failure.—Engineering and Contracting.

Alleys in the City Street Plan

Should the street plan of a city include alleys? If so, why? These were two of a number of questions discussed by Charles B. Ball, Chief Sanitary Inspector of Chicago, in a paper entitled "The Alley Problem," read before the fourth National Conference on Housing in America, recently held at Minneapolis, Minn. Some extracts from the paper follow:

An alley may be defined as a minor public thoroughfare, not exceeding 20 feet in width, extending through a block, in order to afford access, light and ventilation to the rear of the premises which abut upon it, as well as a suitable location for the public-service mains.

Three basic considerations in regard to alleys are: (1) Every alley must be dedicated to public use to permit the city to pave, clean, light and police these spaces. (2) Every alley must extend through the block from street to street. (3) Every alley must have a uniform width of not less than 16 feet.

Alleys exist in more than two-thirds of the cities of the United States, and, with two or three exceptions, are still laid out in additions to these cities. The great example of their non-existence is the City of New York, where they are intentionally absent. I am unaware of any recently planned cities in which alleys have not been provided, although doubtless there are a few.

The self-evident advantage of alleys is that they afford facility of access to the rear of premises for the supplying of goods—fuel, ice, milk, groceries, etc.—as well as for the removal of waste materials, such as garbage, ashes, rubbish and the like.

Attention has been directed for a year or two past to the tremendous distance traveled by the delivery wagon in making its ordinary deliveries, as well as to the waste of effort in the collection of household refuse where alleys are not available. It should be observed that the services referred to can be performed with a saving of fifty per cent. in distance traveled where alleys exist, as contrasted with blocks in which the service must be performed by street access only.

In addition to the marked saving of distance, as well as the convenience affected by alley access, it must be granted that the natural and desirable place of entrance of all those who perform services of this nature—for example, the iceman—is at the rear of the building rather than at the front.

One of the advantages of an alley system, hitherto little realized, is the convenience and speed with which fire-fighting apparatus may be brought through it into use.

Another advantage of alleys is that they afford more convenient access for the storage of vehicles on the rear of the lot. The man who has a small business requiring only a single delivery wagon, would much prefer to keep that wagon, whether it be horse or motor propelled, at the rear of his lot. The convenience of the user of an automobile is greatly enhanced by being able to store it on his own premises instead of at a public garage.

In addition to the valid arguments already set forth to show why alleys are needed, the principal reason for their existence is still to be urged. An alley through the centre of every city block is required because by this means alone is it possible to assure for the future a sufficiency of light and air in the middle of the block.—Engineering News.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

Shells and patriotism at reduced rates is the latest bulletin posted at Ottawa. Mr. D. A. Thomas had something to do with the price of shells but a federal minister who asked for subscriptions for machine guns is responsible for the cheap patriotism. Subscriptions came with a rush till enough had been received to purchase 1,700 guns and then it was discovered that an order for all available machine guns had been placed long ago. So while they are figuring what they'll do with the money you can become a No. 1 hard patriot by donating the price of a machine gun. And it won't cost you a cent for they can't get the gun.

* * *

"I long to be a colonel and with the colonels stand" may be the college yell of Sir Sam Hughes' 1915 class of Honorary Colonels. And after all they may serve a purpose. With colonels so numerous it is quite a distinction to be a private. That should help recruiting.

* * *

D. B. Hanna, third vice-president of the Canadian Northern Railway, stands accused of being an humorist. During the recent joy ride of senators and members of parliament over the line Mr. Hanna found occasion to remark "It was important M. P.'s should see their own property." Whether either the aged denizens of the Senate or the sprightly young members of the Commons smiled deponent sayeth not. But it was a joke even if it was on our representatives elect or rather on the country. For the people of Canada have paid for the road from the first shovelful of mud to the last spike, though the title thereto is in the name of Mackenzie & Mann. And the joke will be all the more pointed if the joy ride was the prelude to another "loan."

* * *

Here is an absolutely true story from the fighting line in France. One of the brightest and most capable commanding officers sent from Ontario was one day hurrying forward his battalion to support a threatened line of trenches when he noticed a motor car at terrific speed approaching him. To save his men from being run over he halted them. The car, a beautiful $10,000 Rolls-Royce, stopped and out stepped a man in the uniform of a Chief of Staff and shouted "What in h— are you doing here?" My friend, believing himself in the presence of Lord Kitchener or Sir John French, saluted and approached the car to make his report. To his amazement he recognized an old friend, a Canadian real estate man and now an Honorary Colonel—"attached." There is more to this story, but the above serves to illustrate the indignity the really efficient officer is compelled to put up with. The Canadian people undoubtedly paid for this car and its running expenses. This is but one instance of how our money is being wasted and to what Canadian officers are being subjected.

* * *

Mr. D. A. Thomas, representative of Lloyd George, British Minister of Munitions, has left us—with a rather bad taste in our mouths. To be sure he has straightened out the "shell game," paved the way for the reorganization of the shell committee and arranged that in future all purchases of munitions shall receive the direct attention of Lloyd George whose representative in this country shall be Mr. Lionel Hitchins, former head of the Cammell Laird Company. Mr. Thomas has also assured us that we are a great people with a great country, and that while the Shell Committee may have charged the Mother Land more for shells than they could be bought for across the line, Canada is perhaps entitled to the preference. Despite this diplomatic language, however, Mr. Thomas took the necessary steps to ensure an early cessation of the preference. And despite his honeyed words and engaging smile you cannot help but suspect that when he gets back home he will whisper in Lloyd George's ear that the days of the Empire's stress has bred in Canada a brand of patriot who is worthy to wander down through history hand in hand with the embalmed beef philanthropist of the Spanish-American war.

* * *

But if it is Mr. Thomas' good fortune to leave us with words of cheer on his lips and an openly expressed wish to let the "dead past bury its dead" so far as past sins are concerned, it is perhaps well not to give all the credit to one man that now the Empire is to get a dollar's worth of shell for a dollar from the most loyal of her sons. Since everything is being hushed up and the Shell Committee is being quietly and decently buried, it is impossible to get statements under oath. But private information from the seat of trouble indicates that Mr. F. P. Jones, manager of the Canada Cement Co., had much to do with the upheaval that sent Mr. Thomas home happy and the Canadian Shell Committee into permanent retirement. Mr. Jones like many another went to Ottawa with a tender for shells. When the contracts were let they went as usual to the favored few and Mr. Jones was not of them. Those contracts were let at prices lower than previous contracts but higher than Mr. Jones' tender. Unlike many another Mr. Jones did not throw up his hands and go home. Instead he went straight to Sir Robert Borden. The Premier was not inclined to listen to a disappointed tenderer but when Mr. Jones turned to the door with a decisive "Very well, I'll give my statement to the press," he was invited to call again in a couple of days. On the second visit he found Mr. Thomas with the Premier. Mr. Jones sat down at the typewriter and made three copies of his statement, one for the Premier, one for Mr. Thomas and the third he kept. That statement showed that the contracts let by the Committee were just $21,000,000 higher than if awarded at the rate of Mr. Jones' tender. A cable to England stopped the contracts before they had been approved by Lloyd George. And in future all contracts for munitions will be open to competitive bids.

* * *

Of course explanations were in order and they were made. It was pointed out that certain concerns had taken risks when shell making was an experiment that might prove costly to the makers and these concerns were entitled to consideration. And probably they were. The earlier price charged the Empire was $5.15 for machining a dollar's worth of shell. This was later reduced to $2.90 for doing the same dollar's worth of work. At these figures one would naturally conclude that it was the Empire and not the experimenter, or rather contractor, which was entitled to any consideration that was going. Again it was pointed out that policy demanded that the contracts be spread around so as to help relieve commercial depression brought on by the war. And it is only fair to add that this policy has been more or less successful. There has been no noticeable commercial depression at or near the concern of which Mr. Thomas Cantley is the head and which is said to be making more profits in a month than it ever did before in a year. Neither is the company of which Mr. G. W. Watts is representative making any complaint of hard times. Of course it is merely a coincidence that Mr. Cantley and Mr. Watts are both members of the Canadian Shell Committee. It is clearly understood that the manufacturing members of this committee are there in a purely advisory capacity and it is probably to clear them of unjust suspicions that their names are not expected to appear when the new Munitions Committee is appointed.

* * *

But while it may be policy at this time of stress to smooth matters over so that the fight for the freedom of the world may be successfully carried on, suspicions have been aroused that cannot be set at rest by simply inaugurating a new system of purchasing munitions. Mr. Thomas may diplomatically suggest that "public sentiment will be met by the retirement of the manufacturing members of the committee," but he knows and all Canada knows that such action will stimulate suspicion rather than meet public sentiment. Everybody has heard of manufacturers who have wanted to tender on shells and who were not permitted to even see the specifications; of manufacturers who failing in their attempts to make any headway at Ottawa have on their return home been offered contracts by middlemen; of at least one patriotic manufacturer who offered to make shells at cost and who was never given a chance. All this has been borne with an equanimity born of long experience with politicians and high financiers. The motto has long been "Watch either one but when they get together get both hands on your money and sit on your hands."

* * *

But in this case a much larger issue than mere money is involved. That Shell Committee was appointed by the Government, was representative of the Government and consequently representative of Canada. In so far as our dealings with the British Munitions Board is concerned that Committee was Canada. And in this great war, which Lloyd George has said is a war of munitions rather than men, shall it be said that when the Empire called for aid, when the brave men in the trenches shouted for munitions, Canada rushed to their aid with $1 worth of shell in one hand while the other was held out for $5.15? Shall it be said that while we are wont to twit the United Statesers with their fondness for the dollar our own country has outdone them in the hour of the Empire's peril? It is unjust that Canada should be allowed to rest under any such stigma; it is unjust that the manufacturing members of the Shell Committee should be retired under suspicion of having placed such stigma on their native land. In justice to those men and in justice to Canada the shell contracts and the Shell Committee should be given the fullest and most searching investigation. Neither should that investigation be held before any white-washing parliamentary committee. It should be held before a court free from party bias and interested only in bringing out the real facts. In this way and this way only can Canada's name be cleared and the Committee given its opportunity to absolve itself of suspicions, that cling to it and will continue to cling so long as efforts are being put forth to cover up its actions.

* * *

To the Empire in her hour of need Canada has given freely of her substance and her sons. She has gloried in the opportunity to prove that her relations toward the motherland were those of a partner rather than a dependent. From the Atlantic to the Pacific Canadians have voiced but one sentiment: that the Dominion must spend her last dollar and her last drop of blood to preserve those liberties guaranteed by the Union Jack and to crush the militarism that threatens the freedom of the world. That is the true Canadian spirit and behind it are united even those who mocked at the German peril and caviled over expenditures towards increasing Britain's naval power. If a few individuals have found, in the nation's hour of stress, their opportunity to make financial gains, all Canada should know it and all the world should be shown that they do not for one instant represent Canada's attitude towards the Motherland.

* * *

I will have something further to add to this shell game in next issue. The awarding of shell box contracts will also be gone into.

SEARCHLIGHT.

Appreciation of the Engineer

In large public works the daily press is always on the lookout for a scandal. Padded estimates, top-heavy payrolls, inferior construction at high prices, and extra work are fair game for reporter and editorial writer. This sort of material makes a "good story," and on some of the yellow journals the standard of practice seems to be never to allow the facts to spoil a good story. For this condition of affairs engineers are in part responsible. They are, or think they are, "too busy" to let the public know about the work under way, and this attitude has been responsible for the all too general belief that there must be some graft connected with every city or State contract. To claim that all public work is clean would indicate an amazing degree of unsophistication, but the stigma of crookedness should not be all-inclusive. In pleasing contrast to the muckraking story is the commendation of the Winnipeg Aqueduct work in a recent issue of the Manitoba Free Press, following a public inspection of the work. In an editorial that journal pays high tribute to the civil engineer's part in the project for delivering a new water supply to the Winnipeg district through a 100-mile conduit. This work, to which James H. Fuertes has devoted his energies as consulting engineer, has involved also the building of a standard-gauge railroad line, primarily for construction purposes, and the Canadian paper sees in the undertaking not merely a means of securing a better water supply but an opportunity of "opening up a magnificent farming territory, until recently supposed to be nothing better than swamp, muskeg and scrub brush. The road was built as a necessary step toward the aqueduct but now promises to justify itself as an economic venture." With public opinion behind it, the course of the Winnipeg Aqueduct work should be fairly smooth.—Engineering Record.

First Through Train over Canadian Northern Pacific

The first through train over the line of the Canadian Northern Pacific Railway left Montreal, Que., on October 12 at 5 p.m., and arrived in Vancouver, B. C., early on the morning of October 19. The trip was made as an inspection of the line preliminary to the inauguration of regular service on November 1, which commenced with a through passenger train service of three times a week. On the special train were twenty members of the Canadian Senate, fifty members of the House of Commons and thirty newspapermen

The last spike in the new transcontinental line was driven at Basque, B. C., 182 miles east of Port Mann on January 23, 1915. The system opened its first line in central Manitoba in 1896, and now has in operation approximately 10,000 miles of single track.—Engineering Record.

Germany's Preparations for the Industrial Struggle After the War

SO many generalities have been forthcoming con- which are based on nothing but mediocre infor- the war in the industrial world—generalities cerning the war, and what is to happen after mation supplied by club gossip and conversation with the man in the street—that it is interesting to find in the London Engineer a critical analysis of the important subject set forth in the heading of this article.

The article is a comprehensive one—the first of a series—and space will only admit of our publishing an abstract of it; but the abstract has been made with care, and it will be followed by others from later articles—our object being, in common with that of our contemporary, to elucidate the situation from facts which have occurred since the war has reached what may be termed the "chronic" stage. Certain it is that it is quite impossible to consider British interests—and in this we include Canadian interests in a large measure—during and after the war without taking into consideration the internal economic situation of our Allies, and also of our enemies.

We venture to express the opinion that the information given in our abstract of the article contributed to The Engineer by a specially appointed commissioner, dealing as it does more particularly with the steps already taken by our enemies to crush Britain's foreign trade after the war, will throw a powerful light on a subject of vital interest.

We quote the following:—

"Thinking men in Germany have given up the idea of that immediate world conquest of which a short time ago we heard so much. That is now to be left as a legacy to their sons' sons. The war as far as Germany is concerned is now being waged for the purpose of securing advantageous peace terms. The great factor now, from the German standpoint, is to obtain such terms as will enable her to retain her influence in the world and leave her free to prepare for another great military struggle in years to come, when her adversaries have gone to sleep again. I do not say that that dream is realizable, but at all events it **is** the dream of the Germans to-day, and, with that thoroughness and forethought which characterizes our enemies, every step is now being taken to prepare for a peace which will permit them to prepare for the next war.

Allies Must Control German Trade Expansion

"It should be quite clear to most people that unless the terms of peace are of such a nature as to make it impossible for Germany to carry on her foreign trade except upon terms to be dictated by the Allies, she will very soon be over-running the world again with her products. It should be equally clear that, unless the German element is eliminated once and for all from international finance propositions, and unless the Allies can prevent outside money from being used to foster German industries, her facilities for spoiling the legitimate trade of the world will soon be as great as ever. There is no evidence at present to lead one to suppose, whatever the outcome of this war may be, that the Allies are united in their intention to impose all or any of such conditions. But, unless they can and do effect something of the sort, the position of Germany after the war must be infinitely stronger as compared with that of the Allies for absorbing the trade of the world.

A Pernicious Fallacy

"Before dealing with the question of the influence of Germany now being exercised in the various countries, it is well to explode one of the most pernicious and widespread fallacies in connection with her relations with the outside world. We have been constantly told for months past that Germany's exports have ceased, that the blockade of her frontiers and ports has made it impossible for her to send goods to the outside world, except to those neutral countries that are immediately adjoining her. We are also told that although she may be sending certain produce to such neutral countries, she cannot possibly be exporting engineering plant for the simple reason that she is short of the essential materials and that every available man in Germany is either a soldier, or is occupied in manufacturing munitions or producing something that is required for military or essential domestic necessities.

"That is purely a popular fallacy. It is months since we were told that the housewives of Berlin were throwing their stew pans into the common melting pot to provide the materials for munitions and that private premises were being ransacked for the sake of the wires of the domestic electricity supply for a similar purpose. The former is unquestionably true and there is no reason to doubt the scarcity of copper and other essential materials, but the fact remains that Germany is not only manufacturing machinery for munitions purposes, but is working for export and is actually exporting machinery. Nor are her exports in this respect confined to Holland and Denmark and Switzerland, or even to Sweden and Norway, but they are finding their way to countries much further afield.

'Portuguese' Machine Tools for Great Britain?

"For instance, I have evidence from two sources that ever since the war started Germany has regularly been supplying machinery to Portugal. The main channels through which such goods find their way to that country are via Holland and Switzerland. In fact, I am informed by a man in the machinery business there that he has been urgently requested to create a sale in Great Britain for 'Portuguese' machine tools, made in Germany.

"Of the bulk of Germany's present-day export trade in machinery I am unable to give any figures, but that it is by no means a negligible quantity is shown by a Danish machinery importer, who recently wrote stating that since the war the importation of German machinery into Denmark was not so great as previously, as the number of men employed on such work only amounted to from 25 to 50 per cent. of the normal total.

"I give these details, not merely to explode the dangerous fallacy that Germany is doing no foreign trade, but to show the herculean efforts she is making to keep in touch with the world's markets. I have evidence, and so has the British Government, that in neutral countries all over the world—such, for instance, as South America and China—German agents are canvassing for and accepting orders for machinery as actively as if there were no war. I have no evidence to show how far she is effecting deliveries, but one of the stock arguments of German travellers in those far-off countries is that since the war their firms have bought up or become interested in manufacturing concerns in the United States, and that they can manufacture easily in that country goods which cannot for the time being be exported from Germany.

Germany's Far-Seeing Preparations

"By every means in her power, therefore, Germany is keeping open those markets from which she hopes to reap a large harvest as soon as the war is over. There can by no conceivable means be any immediate or direct profit on such transactions to the German seller. The restrictions as to her outlets are so great, the cost of transport so high, the routes so circuitous and the conditions of manufacturing so unfavourable, that German manufacturers must be losing on every machine they dispose of in this manner. Then why does Germany do this? It constitutes one of her far-seeing preparations for prosperity after the war. In the first place, it secures a certain continuity of trade, and in the second it impresses neutral countries with the vitality of German traders even in their present conditions. It is a hollow echo of that hackneyed cry 'Business as usual.' But such as it is, it serves a great purpose from the point of view of Germany's future trade prospects, and it contrasts significantly with the policy of the British Government.

"But while Germany is struggling to maintain a semblance of foreign trade, she has also organized herself carefully for crushing the trade of the Allies after the war. As far back as October last she had created an economic alliance with Austria, under which imports from the Allies were to be prohibited and a condition of peace was to be the total abolition of duties on German goods in all the Allied countries. A similar policy was to be pursued also in all other countries on which Germany was strong enough to impose her will. Among other provisions was one to the effect that the Allies were to be broken financially for generations to come by the tribute that they would all have to pay to Germany. I need not deal at length with this precious programme, because it is based on the assumption that Germany is to win the war. If she is defeated, of course, that programme loses much of its force. Defeat, however, would not rob it of its ingenuity.

Belgium Body and Soul German Unless—

"But the ingenuity of Germany in hedging against defeat is more remarkable in Belgium than in any other country. In fact, unless the Allies co-operate for the purpose of counteracting Germany's action in that country, Belgium will actually belong body and soul to Germany after the war, even when we have driven her out of the territory she is now occupying.

"It is well to note that many of the most important German officials who are now actively enforcing German rule in that country are men who have lived in Belgium for very many years, during which time they occupied a variety of peaceful callings. Many of them were not known to be Germans at all, but their intimate knowledge of the country and its people has given Germany a far stronger hold on it than is generally realized. Those Germans have now been in uninterrupted power for twelve months, and the brutality which characterized the German occupation in the earlier days has now merely changed its form. Instead of murdering the men and burning their property, the Germans are now merely trying to murder their self-respect and to seize their businesses. A clumsy but persistent effort is being made to get on to a friendly footing with the Belgians. The cry of 'Kamarade,' 'Kamarade,' is the order of the day But it meets with no response. In a few words, the argument used by the Germans is to the effect that they have been there for a year and that they will always be there, that they are consequently all one people and they ought all to pull together. 'We have destroyed your factories,' they say. 'Never mind, we will reconstitute them on a very much more elaborate footing than in the past. We will go into partnership with you.' 'We have robbed you of your money by war levies and other means. We will find the money necessary now that we are Kamarades and —partners.' To those Belgians who show some doubt as to how the Germans will find the money after the war the reply is ready enough. They have made all arrangements for the money from financial people in the United States. There seems to be no doubt that this assertion is literally true. This stratagem has the enormous double advantage of hedging against a condition that might reasonably be expected to be imposed by Belgium after the war to the effect that no property might be owned in that country by Germans. While such an injunction might well be imposed on an enemy after defeat, it would be difficult to enforce it against the people of a neutral state. In fact, it is said that of late a large amount of industrial property held by Germans in Belgium even prior to the war has already been made over to men-of-straw in the United States.

"It is only natural to suppose that these specious arguments from conqueror to conquered, from the man in possession to the man without money, must have already had some effect, and that the longer the war is protracted the more completely the absorption of Belgian industrial property by the Germans will be effected. There is only one remedy for this. It is already too late for prevention. The terms of peace must nullify all such contracts and industrial ists in England and France must step into the breach and associate themselves with the Belgians in reconstituting their industries. Such a measure would, apart from the question of sentiment, prove very profitable. It would also do more than anything else to hold in check German trade expansion after the war.

German Influence in Russia and Other Countries

"Germany's influence in the other countries with which she is at war is of a widely different nature. In Russia she has two very powerful allies among the community. The first is in the very highest circles. Germany has for years set herself to support all that is reactionary in Russia and in the immediate entourage of the Czar there have been and still are many officials of German extraction, and who are entirely German in their views. It is they who before the war had always striven to break the Franco-Russian alliance on the ground that it placed the autocratic regime of the latter country in jeopardy. It is they who systematically since the war began have striven to prevent that rapprochement between the Czar and his people which came about in so striking a manner as the result of the war, and are now endeavouring to show that the popular voice in Russia is a greater danger to the throne than Germany with whom they are fighting. An alliance with France and England, they maintain, means death to autocratic government in Russia. Germany, which in effect is an autocracy, is the only fit partner for Russia. The other powerful ally of Germany in Russia is the Jewish element. Largely, the so-called Russian Jews are actually of German origin. They all speak German, and it was through the Jews that Germany first acquired her trade footing in Russia. Germany is holding out to the Jews a prospect of the millennium under German rule. There will be no more persecution, no more 'pogroms.' Up to now Russian patriotism has been sufficient to drown the voices of the pro-Germans, but the danger is there and increases with the protraction of the war.

"Of Germany's trade designs on Russia after the war there are many evidences and perhaps the most significant of all is that the hundreds of thousands of German prisoners now in the hands of the Russians are all systematically studying the Russian language so that they may be in a position to take up business in that country immediately when the time arrives.

"In England and France, Germany has the all-powerful lever of finance. It is doubtful if the extent of that influence is grasped. In Russia, though the finances of the country were largely in the hand of Germans, Russia found herself when war broke out in the enviable position of a debtor to the country she was fighting. She could, therefore, cancel, for the time being at all events, her indebtedness to Germany and confiscate German property in Russia for the reason that there was practically no Russian property in Germany to be confiscated by way of reprisal.

"In England and France the position is reversed. The German Empire has been built up on British and French money, and when the balance of the hopelessly involved finances between Germany and those two countries is struck it is found that England and France are the creditors and Germany the debtor. It is for this reason that the financier, who would be very surprised if you accused him of being unpatriotic or pro-German, is the man whose influence is behind the Throne in this country and is responsible for all the weak-kneed legislation in this country relating to Trading with the Enemy. It is the financier who will tell you that so far from crushing German trade after the war, we must foster it for the sake of getting our money back. The influence of the financial man is by far the most difficult problem with which our Government has to deal."

Notes on Sewage Treatment and Disposal

By R. O. Wynne-Roberts*

IN the previous notes some references were made to the design of the collectors at Philadelphia. Since writing those notes the writer has perused a report submitted in January, 1914, by Mr. Datesman—one of the engineers already named—to the Metropolitan Sewerage Commission of New York. Mr. Datesman then mentioned that the only form of regulation of storm water discharges to be installed at Philadelphia would be dams built across the combined sewers, but apparently this simple arrangement has been altered to include a side outlet controlled by a butterfly valve. Mr. Datesman calls attention to the fact that the dam across the combine sewers may constitute an integral part of the intercepting sewer which crosses underneath and and more or less at right angles to them. The dams need not be solid or of any particular profile; they may be hollow like an Ambursen dam, and in that case may form the upper portion of the intercepting sewer itself. The adoption of such a design means the reduction of excavation, which, if in wet ground, is a very important item, and when it can be reduced by this means a tangible economy is effected. Of course, the adoption of such a plan depends on local conditions, as to whether other works are necessary. In Philadelphia it has meant the construction of certain subsidiary sewers which would not be necessary with deeper collectors. The reduced depth of intercepting sewers also means smaller pumping lifts, which entails a permanent expenditure, and if capitalized will always represent a goodly sum of money.

Screens and Detritus Chambers.—The design of screens and detritus chambers and their use in sewage treatment are worth discussing. Where effective disposal of sewage by dilution is possible, fine screens are probably necessary. The design and construction of fine screens have been developed more fully in Germany than anywhere else. One reason for this is the fact that there are in that country good-sized and rapid-flowing rivers to receive sewage. It is essential, however, for the sake of appearance, that floating matter should be eliminated. Russia imposes a condition that solids greater than a certain size shall be removed by screening. Where sufficient dilution is not possible, and when water supplies must be profected, then screening is usually supplemented by other processes, to which reference will be made further on.

The line of demarcation between fine and coarse screens is arbitrarily fixed according to the individual judgment of different engineers and makers, and for the sake of distinction Mr. Kenneth Allen's limit of 0.6 inch slots will be accepted.

The subject of screening was treated in a most comprehensive manner recently in a paper by Mr. Kenneth Allen before the American Society of Civil Engineers, which was discussed very fully by the leading engineers of the United States. Many of those who conducted experiments in different American cities took part in the discussion, so that reports issued by the cities already named and the above paper and discussion are so intimately interlaced that in an article such as this it will be difficult to deal with the subject without being guilty of some tautology. It will, in any case, be impossible to make anything more than a few general observations. Those desirous of obtaining fuller information are recommended to peruse the published report, proceedings, and transactions, which will well repay them for the time and labor involved. The writer will quote frequently from Mr. Allen's paper and the discussion thereon, and full acknowledgement is here made, so that the writer will not be guilty of plagiarism when utilizing information gleaned from many sources.

Grit chambers and screens have each their particular function in the treatment of sewage. Grit chambers are intended to remove mineral matter only, for which purpose the velocity of flow should be such as to permit the deposition of sand, grit, and other mineral ingredients without allowing organic matter to settle. To attain this condition the velocity of flow should be as uniform as possible, regardless of the volume of sewage that has to be treated; consequently arrangements must be made to allow grit to settle by providing a series of chambers which will come into commission automatically as the height of the sewage in the conduit increases. Trouble has been experienced in some detritus pits owing to their capacities being too great for dry-weather flows. Sludge as well as grit settled, and this necessarily complicated matters, but by proportioning the chambers so that the velocity should be, say, about one foot per second, the deposition of sludge could be obviated.

Grit chambers ordinarily have screens also, and these are designed according to the particular requirements the engineer has in view.

In the Philadelphia experiments they had a cone covered with red metal cloth 32 meshes to the inch and having clear openings ½ m.m. square. Sewage was applied to the screen through twenty-four ¼-inch nozzles. On an average the sewage applied contained 200 p.p.m. (parts per million) of suspended matter, and the average effluent contained 133 p.p.m.; so that the removal of suspended matter was about 33 per cent. It was found that screened sewage after plain sedimentation did not clog the fixed nozzles which sprayed the filters, whereas the same sewage unscreened caused trouble; screened sewage prevented the formation of scum and improved the quality of the tank effluent. It increased the volume of sludge by 14 per cent., but reduced the quantity of dry solids by 20 per cent. Sludge from screened sewage dried more rapidly than that from unscreened sewage.

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Fine screens may be classified as follows:—

(1) Band screens—such as the Jennings screen at Chicago, Brunotte screen at Hamburg, and Carshalton screen in England.

(2) Wing screen—as at Frankfort, Bradford, etc.

(3) Shovel-vane screen—as at Strassburg, etc.

(4) Drum screen—designed by G. Windschild, and installed at Trier.

(5) Cylinder screen—designed by O. M. Weand, and installed at Reading, Pa., and Brockton, Mass., Atlanta, etc.

(6) Disk Screen—devised by Riensch and developed by Wurl, and therefore known as the Riensch-Wurl screen.

There are other screens on the market, such as those with fixed bars and travelling forks, to rake off the garbage collecting on the screen. Cage screens are used at some plants in Canada. Paris employs a coarse band screen and behind it a vertical fixed fine screen. It will thus be observed that there are many kinds and different combinations of screens.

Band Screens.—The Hamburg band screen is built up of 14,000 links of aluminium alloy held together in sections by angle iron frames. There are two screens, and in each there are 46 sections. Each screen is 33 feet long, 10.8 feet wide, and 19 feet high over all, inclined at an angle of 63 degrees to horizontal, and travels at the rate of about one to two inches per second, for which purpose a 2½ h.p. electric motor is used. Another 2½ horse-power is required for the cleaning apparatus, which is placed behind and near the top of the screen. This apparatus has a number of prongs which move in and out of the links, and is operated by an electric magnet. The screenings are scraped off to a belt conveyor and by it removed.

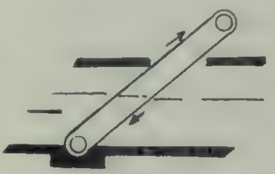
Another German band screen is that at Gottingen, where the wire mesh is used instead of links. This screen is rotated at a speed of 8 feet a minute by an Anderson water-wheel, and cleaned by a brush and water jets.

There are several band screens in use in Great Britain, of which the Carshalton wire screen is probably the best known. This is like the Hamburg screen; it passes over rollers—one in a pit below the invert of the sewer, and the other on a frame at or near the ground surface. This screen is operated by an undershot water-wheel, and cleaned by revolving brushes.

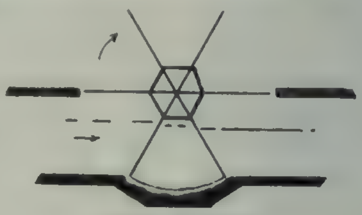
The Jennings band screen is employed on the Chicago stockyard sewer outlet into Bubbly Creek. This screen is in the experimental stage, and possesses some novel features. The writer had an opportunity of inspecting it in June last. As is well known, the sewage from the above stockyard "is high in suspended matter, running from three to six times as strong as the average city sewage. From a study made, it is estimated that the stockyard region supplies as much as one-fifth of the entire settling suspended matter of the city" (Chicago).

Jennings' screen is built of removable frames covered with fine Monel metal wires, 40 meshes to an inch. It passes over rollers, as in the other kinds of band screens. The screenings are brought up, and as the screen passes compressed air under 1½ lbs. per square inch gauge pressure is discharged beneath it to remove the refuse collected thereon. Sewage containing 700 p.p.m. suspended matter was screened, with the result that 63 per cent. were removed. The moisture content of the screenings was on an average about 73 to 79 per cent.

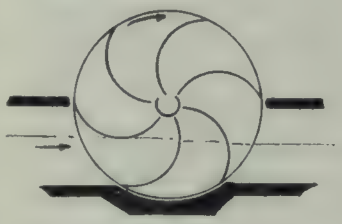
There is another type of band screen which has not been referred to in any recent paper or discussion. It was in operation at Bristal (Yorkshire) in 1897, and is described in the author's book on sewage disposal works published in 1898. A short statement may be interesting. It was designed and constructed by Mr. William Birch, of Manchester, to treat the sewage of Bristal, etc. The object was to strain sedimented sewage. Birch's screen consisted of an endless band of felt or canvas passing over a series of rollers, and on to which the sedimented sewage was made to flow. The felt, while readily permitting the water to filter through, retained all solid matter. The strainer moved slowly out of the tank in which it was immersed, carrying with it the solids, and passed over a large cylinder, and thence between two other cylinders which were situated above the centre of the tank. The suspended matter retained on the felt was washed out by an ingenious cleansing and washing arrangement, leaving the felt sufficiently clean for further work. The sludge was passed by another band on to revolving drums, and the water expressed out by rollers. Unfortunately, no data are available as to the efficiency of this plant.



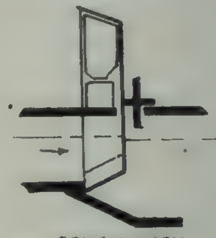
BAND SCREEN.



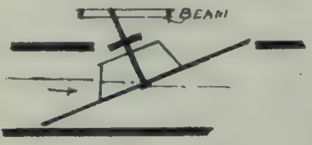
WING SCREEN.



SHOVEL-VANE SCREEN.



DRUM SCREEN.



DISK SCREEN.

These diagrammatic sketches, copied from Mr Kenneth Allen's paper, indicate the various classes of screens.

Wing Screen.—The name given to this class does not seem to be quite appropriate, as it does not suggest its general structural features. This screen consists of a number of arms or vanes radiating from the axle. In Frankfort there are five vanes, in Bradford six.

In Frankfort each vane consists of steel bars 0.4 inch by 1.20 inch, 0.4 inch apart, forming a screen 6.56 feet wide and 9.84 feet long. These screens are operated against the stream by 2.3 h.p. electric motors, and as the vanes rise slowly from the sewage they bring up their loads of refuse. A rubber scraper, hung at each end to a long arm and therefore provided with ample free movement, rests on the vanes near the axle, and as they rotate they push forward the scraper and with it the refuse, until the latter is discharged from the extreme end of the vane on to a belt conveyor and the scraper is released, to fall on the next vane. The quantity of suspended matter removed by these screens was about 10 per cent., while the grit chambers removed 16 per cent.—making a total of about 26 per cent.

There are two screens of this class in Bradford, England. The vanes are 4 ft. 11½ ins. long, and the screens are 6 ft. 2½ ins. wide, with a daily capacity of 3½ million gallons. The bars are ¼ x 1 inch and ½ inch apart. The chief object of these screens is to remove wool fibre. A rake is used to remove the refuse instead of a rubber scraper as at Frankfort.

Shovel-vane Screens.—This name is a literal translation of that given by the German makers.

(To be continued)

Algae Growth on Sewage Filters

IN the early part of October, 1914, there began to appear on the upper surface of the stones in the sprinkling filter-beds at the Peachtree Creek sewage treatment works at Atlanta a growth that was later classified as blue-green algae, belonging to the Oscillatoria family, and in an article in The Engineering Record Mr. Charles C. Hommow, chemist and bacteriologist in charge at Atlanta, describes how nearly a ton of this material was removed from 2½ acres of beds.

The growth was first noticed forming around the risers and nozzles, but soon spread in a fine green film over the whole surface of the filter-bed. It appeared that the nozzles formed a sort of nucleus, or starting point, for the growth, which gradually became thicker and thicker over the whole bed until in March of this year it was ½ in. thick in places. The heaviest growth extended approximately 3 ft. from each nozzle.

The top surface of the growth was dark green in colour, while the middle and underneath portions were dark brown. It was leathery in texture and quite firm. When the growth was in a healthy condition it clung very tenaciously to the stones, and sometimes when picking up a piece of it six or eight stones would be so firmly bound together by it that they could be carried from the bed without dropping off. In places it caused considerable pooling of the sewage, but at no time was this serious.

Growth Dries in April

In the middle of April, however, the growth began to dry up in places, break loose from the stones, and apparently was going to sluff off and pass through the beds. Some of the pieces were 6 in. square, and fearing they might clog up the lower layers of the filter medium or the underdrains, an attempt was made to remove the growth by raking it off. This was not found practical, so labourers were set to work picking it off by hand. It was found that by letting the growth dry from four to five hours it practically freed itself from the filter medium, and pieces as large as 3 ft. square could be picked up.

The filter effluent contained considerably more suspended matter for a few days after the beds were cleaned, but they went back to normal, and the stones in the beds at the present time are practically as clean as they were before the beds were put into service two years ago. Except for the first few days after the beds were put back into operation there was no apparent difference in the quality of the effluent after the growth was removed. The excellent condition of the filter-beds during the spring and summer months suggests the possibility that the matted growth over the surface during the winter held the suspended matter back, and thus prevented the usual clogging that takes place in filters during the colder months. The underneath portion of the growth of algae appeared to contain material filtered out of the sewage, and there is no doubt that a great deal of suspended solid matter was held back, and much of it oxidized by the algae, which are known to consume a considerable quantity of nitrogen. This class of algae does not give off oxygen to the same extent that some of the other algae do, but the oxygen they did give off and the suspended solids held back and partly oxidized must have been beneficial to the filters during winter.

Effect of Cold Weather

The writer believes that these growths ought not to be disturbed during cold weather, or as long as they remain in a healthy growing condition and cling tightly to the surface of the stone, but when they threaten to break up and pass on through the filters it is time to put the filters out of service, allow the growth to dry out, and remove it.

A saving of $3,296 on sewer work completed this year by the city of Victoria, B. C., is indicated in a report to the streets committee made recently by the City Engineer, Mr. C. H. Rust. The work included the construction of the outfall for the northwest sewer system at Macauley Point, for which bids were asked last fall. The lowest tender, $6,230, was considered excessive, and upon recommendation of the city engineer it was decided to build the outfall under the direction of the city's engineering department instead of by contract. This was done at a cost of $2,934.

A concrete viaduct recently built at Canyon City, Col., has a total length of 742 feet, carries a highway over four railway tracks, an old river bed, a canal, a road and an abandoned irrigation ditch, and connects at one end with a bridge over the Arkansas River. The grade of the bridge rises from both ends toward the centre. The structure consists principally of concrete girder and slab spans varying from 27 to 44 feet in length. In addition, there are two spans crossing railroad tracks, one of 60 ft. and the other of 65 ft. These are steel plate girders, covered with concrete on the outside only in order to conform to the rest of the structure in appearance. The viaduct carries a roadway about 24 ft. wide and one sidewalk about 5 ft. wide, and was built at a cost of about $1.40 per sq. ft. of roadway and walk.

The Design and Construction of the Crawford Street Bridge, Toronto

Staff Article.

PERHAPS no other Canadian city contains a greater number of comparatively large bridges than Toronto. During the summer of 1915 an additional structure of striking appearance has been erected in Bellwoods Park on the line of Crawford Street.

As Bellwoods Park is one of the most attractive rest and recreation areas of the city, special attention was given to the selection of a design which would harmonize with the surroundings and add to rather than detract from the beauties of the environs.

Formerly a wooden trestle bridge, having a roadway 20 ft. wide, with two sidewalks, each 4 ft. wide, served in the place of the new reinforced concrete structure. The present bridge consists essentially of three main spans of the arch rib type, supporting a deck construction composed of spandrel braced columns, floor beams, stringers, roadway, sidewalks, etc. The approaches consist of several small spans of a construction similar to that adopted for the deck construction of the main spans, with U abutments forming the extreme ends of the structure.

The bridge has a total length over all of 292 ft., and a total width over all of 35 ft., providing a roadway 21 ft. in width, face to face of curbs, and two sidewalks having a clear width of 6 ft. each.

DESIGN

Loads and Stresses.—The loads assumed in proportioning the several parts of the structure were as follows:—

Dead Loads:
- Paving and waterproofing, 50 lbs. per sq. ft.
- Concrete, 150 lbs. per cu. ft.

Live Loads:
- Sidewalk, 100 lbs. per sq. ft.
- Roadway, 150 lbs. per sq. ft.
- Twenty-ton road roller.
- Six-ton motor truck.

As will be observed by referring to Fig. 1, the road roller load is concentrated on two axles at 12-ft. centres. The front roller, which is 4 ft. in width, produces a load concentration of 14,000 lbs. The two rear rollers, each 2 ft. in width, and spaced 6 ft. centre to centre, produce a load concentration of 13,000 lbs. each. The roller is assumed to occupy a width of 10 ft.

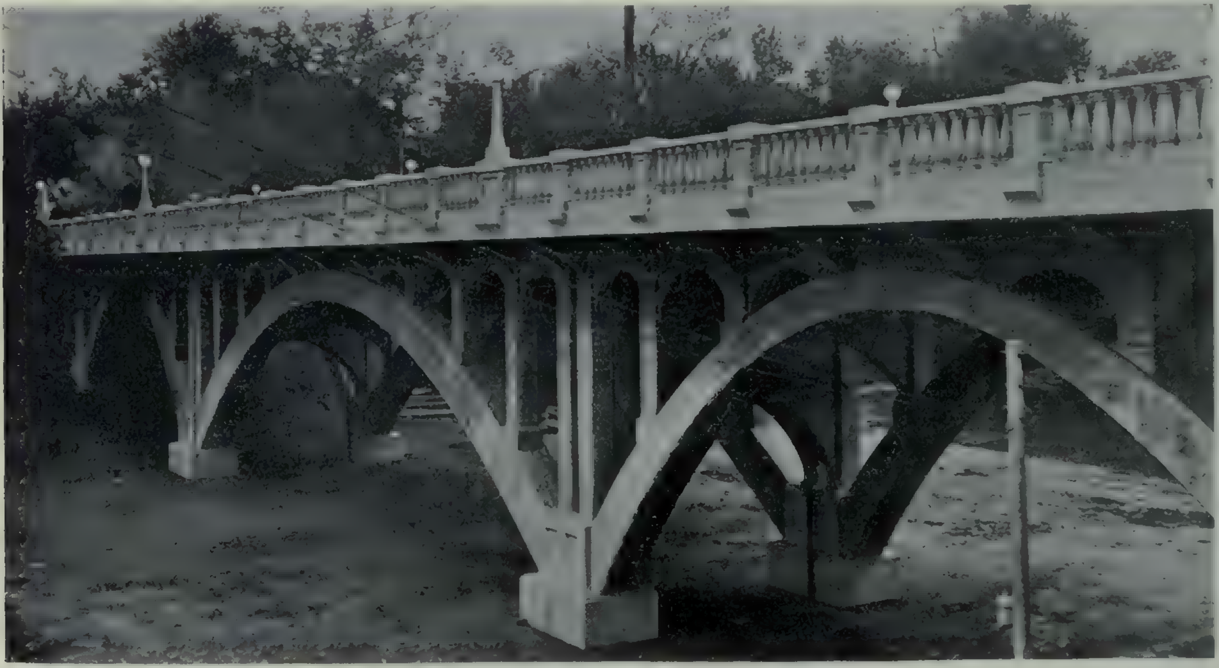


Plate 1.—Crawford Street Bridge—general view.

The 6-ton motor truck is assumed to carry a maximum load of six tons—one-third of the entire weight being carried on the front axle, and two-thirds on the rear axle. As will be noted, this gives a concentrated load of 8,000 lbs. on each rear wheel. As shown in Fig. 1, this load is assumed to be distributed over a width of 2 ft. parallel to the axle, and over a width of 1 ft. at right angles thereto. The assumed allowable unit stresses were as follows:—

Compression in Concrete:
- Columns, 400 lbs. per sq. inch.
- On extreme fibre of beams, slabs, etc., for bending, 650 lbs. per sq. inch.

Shearing:
- Concrete, 60 lbs. per sq. inch.
- Steel, 10,000 lbs. per sq. inch.

Bond between concrete and steel, 80 lbs. per sq. inch.

Tension:
- Steel, 16,000 lbs. per sq. inch.

Details of Design.—The general arrangement of spans, as well as typical cross sections, are shown on the general plan reproduced on page 1162.

The center main arch ribs have a span of 90 ft. and a rise of 20 ft. 9 ins. They have a uniform thickness of 3 ft., with a crown depth of 3 ft., and a depth of 4 ft. at the haunches.

The north and south main arch ribs have a span of 63 ft. and a rise of 22 ft. 6 ins. They have a uniform width of 3 ft., with a crown depth of 2 ft., and a depth of 3 ft. 3 ins. at the haunches. The arch ribs are reinforced with structural steel.

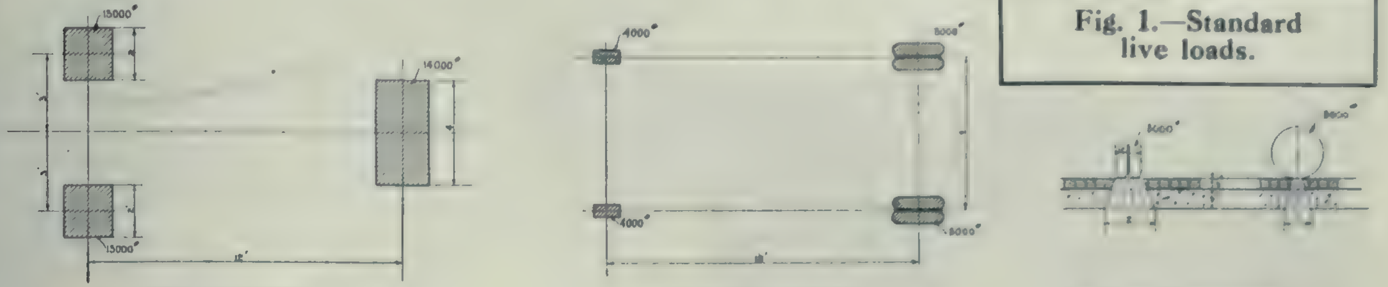


Fig. 1.—Standard live loads.

20-ton Road Roller.

6-ton Motor Truck.

Rear Wheel Distribution.

The spandrel braced columns which support the main deck construction, and which in turn are supported upon the main arch ribs, are spaced to form panel lengths of 9 ft. They are 21 inches square, and are reinforced with triangular mesh.

All floor beams are 21 ins. wide by 43 ins. deep, reinforced in the usual manner with steel rods and stirrups. Details of the floor beam are shown in Fig. 2. All roadway stringers, which are spaced 5 ft. 3 ins. apart, have a width of 11 ins. and a depth of 22 ins., and are reinforced in a manner similar to the floor beams.

The roadway slab has a span of 5 ft. 3 ins., and is 9 ins. thick, it being reinforced with steel rods for both bending and temperature.

The sidewalk slab has a span of 6 ft., and is reinforced with triangular mesh.

The sidewalks are carried on cantilever brackets, which are practically extensions of the floor beams. This feature of the design provides a sufficient projection of the deck beyond the general plane of the arch ribs to accentuate the general effect of the main and spandrel arches.

Transverse bracing has been provided throughout the bridge by means of struts 12 ins. thick located below the floor beams and extending from end to end of same. The struts form a monolithic construction with the floor beams and the supporting columns. An artistic effect is produced by the curved bottom section. Fig. 2 shows the transverse bracing, floor beams, and columns in detail.

Expansion joints have been provided in the bridge floor directly over each pier, as shown in the general drawing. These joints—shown in detail in Fig. 3—consist essentially of bent plates embedded in waterproof mastic and bolted on one side to the concrete slab.

To provide for the free movement of the large sidewalk balustrade posts, located at the expansion joints, a layer of tar paper was interposed on one side of the joint between the bottom of the post and the sidewalk slab. The base and top rail of the balustrade were treated in a similar manner to provide for this movement.

Sidewalk Balustrade.—The specifications called for the rails and balusters to be reinforced as follows: the base and top rails to be reinforced with four ¼ in. square twisted rods laced with No. 16 gauge wire; the balusters to be reinforced through their centres with

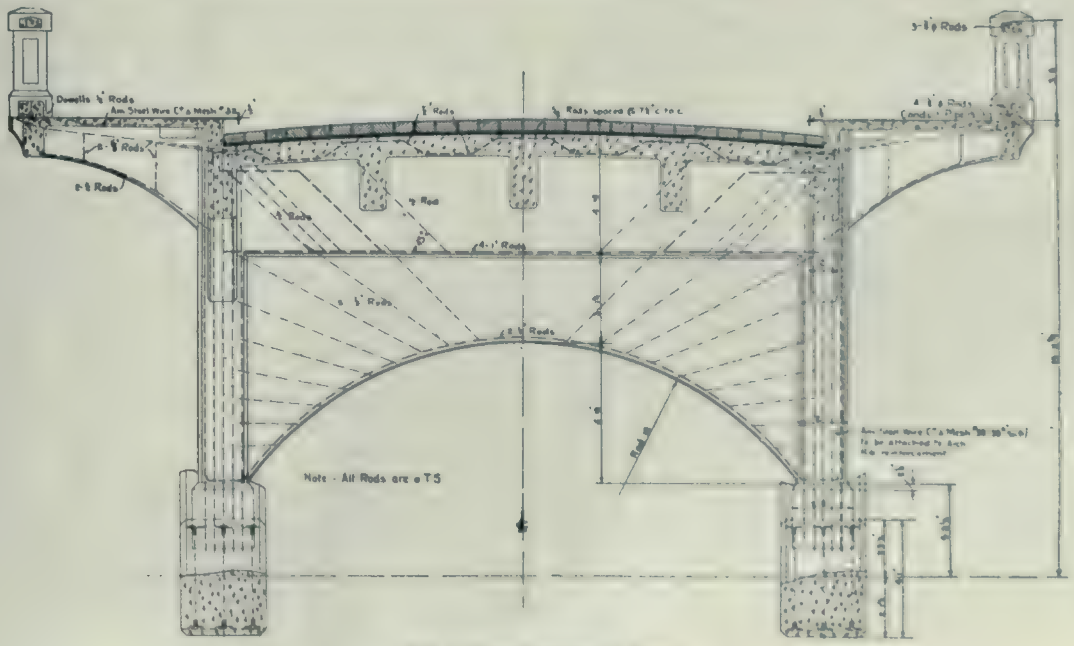


Fig. 2.--Cross sections at piers.

½-in. square rods to serve as dowels at the top and bottom ends.

On each of the large balustrade posts electric light pedestals were provided, wires being led to the lamps placed thereon through 1½-in. black enamelled conduits embedded in the base of the balustrade and in the posts. At the expansion joints suitable sleeves are provided.

Waterproofing.—The following waterproofing was provided for the roadway slab: the concrete slab was first to be given a coating of approved asphaltic primer to bond the waterproofing material to its surface. Upon this was to be applied two-ply of eight-ounce burlap, and two-ply of heavy asphalt felt in alternate layers, each layer being thoroughly saturated with an approved waterproofing compound, the whole forming a continuous waterproof membrane over the entire roadway portion of the bridge. A layer of asphaltic mastic one inch thick was then to be applied to form a protective covering for the membrane.

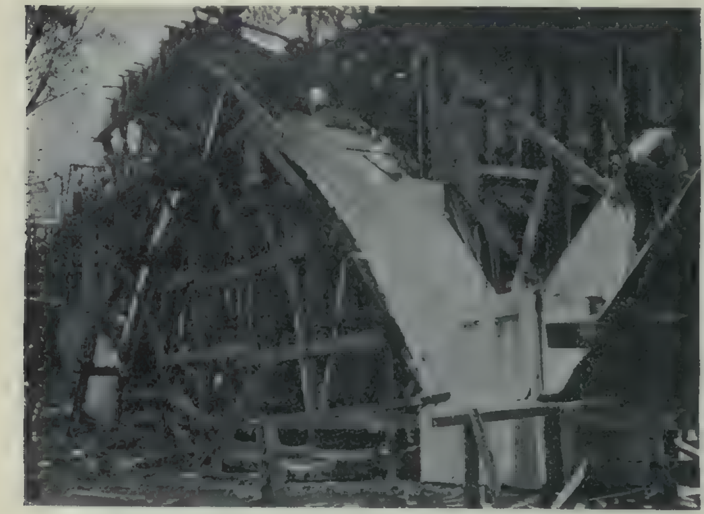


Plate 2.—Arch centering and forms for sidewalk brackets.

Drainage.—The bridge floor has a grade of 1.06 per cent. falling south. On the up-grade side of each expansion joint there is placed on each side of the roadway a steel catchbasin with a cast-iron gulley set thereon. A four-inch wrought-iron pipe projects up through the bottom of each catchbasin to the height of one foot, in order to allow the dead leaves, dirt, and other rubbish carried into the basin to settle to the bottom while the water is drained off. These drain pipes are carried down alongside the piers, and are connected up with the old Garrison Creek sewer underneath the bridge.

Plate 3.—Service trestle.

CONSTRUCTION

Piers.—Following the removal of the old wooden trestle bridge, which constituted the first work done in the field in preparation for the building of the new bridge, the excavations for the piers of the substructure were made. As shown on the general plan, page 1162, the excavations for the piers supporting the main arches were carried to depths ranging from 20 ft. to 35 ft., where a firm shale rock formation was reached, this having ample strength to support the structure. These excavations were of the open pit type, protected upon the sides by 1½-in. sheeting driven as the excavation progressed, and firmly waled and braced to prevent caving of the surrounding material. The presence of quicksand in the lower portions of the excavations made it necessary to use tongued and grooved sheeting. The excavations were made of sufficient size to allow the forms to be constructed within the area of the pits, it being one of the conditions of the specifications governing this portion of the work that no concrete was to be placed in excavations without forms.

The widely differing earth strata encountered in the excavations, and their arrangement, are of special interest. By referring to the Sections of Excavations shown on the general plan (page 1162) it will be noted that the material excavated from one pier pit gave little evidence of what might be found in the next. As soon as an excavation was completed, the form work for the concrete was built and concreting was begun. The concrete of the piers is composed of one part cement, three parts sand, and five parts crushed stone. On account of the transverse stresses resulting from thrusts of the arches of the superstructure, special care was taken that in the top surface of the concrete placed each day a sufficient number of "one-man stone" fillers were partially embedded to give an efficient bond with concrete placed upon a succeeding day.

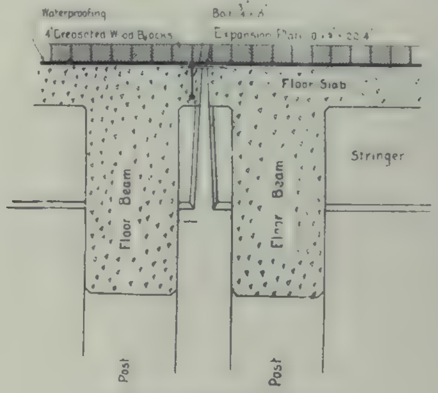


Fig. 3.—Expansion joint.

In the operation of placing the concrete in the pier forms metal-lined chutes were used for transferring the concrete from the mixer to the point of placing in the forms. On account of the depth of the excavations, these chutes were zigzagged to provide against segregation of the concrete materials.

The piers of the small approach arches and the portions of the abutments below the springing line of the spandrel arches were constructed in a similar manner to the piers supporting the main arches.

Arch Centering.—The centering for the main arches consisted of a wooden trussed framework so con-

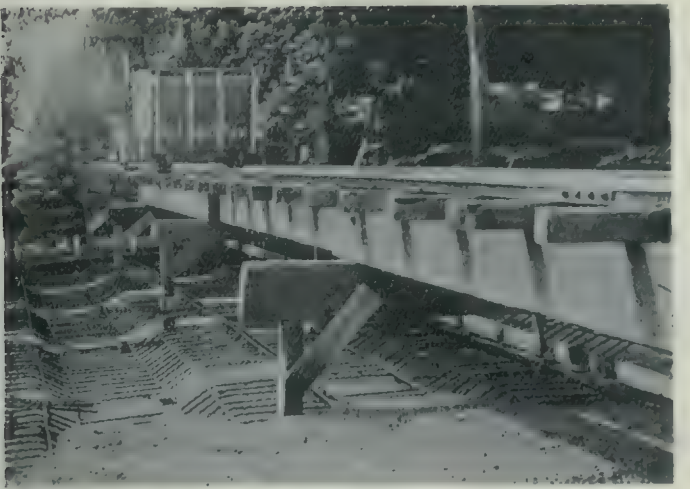


Plate 4.—Concrete buggy; also floor slab reinforcement.

structed as to form a rigid and unyielding support for the arch forms. The details for this centering are shown in Plate 2. The specifications required that "All lagging and timbering of main arches shall be thoroughly saturated with water prior to commencing the construction of the arches, and shall be kept so saturated until the concrete of the deck arches and floor system is completed, and shall then be permitted to dry out gradually as a means of slowly relaxing their support." In this connection it is of interest to note that when the centering and lagging had become dry the latter was no longer in contact with the under surface of the concrete composing the arch rib.

Service Trestle.—As a means of conveying the concrete from the mixer to the point of placing in the forms a wooden trestle was built the full length of the structure. This trestle was designed so as to provide a convenient means of chuting the concrete to all parts of the superstructure. The trestle supports, shown in Plate 3, were so located as not to interfere with the stringer and floor-beam forms. At the time the concrete composing the floor slab was placed, these trestle supports were removed and the stringers of the trestle were supported by means of small posts placed upon the tops of the floor beams.

The metal-lined buggies used for conveying the concrete along the trestle, also shown in Plate 3, and again in Plate 4, were equipped with sliding gates for gauging the flow of the concrete down the metal-lined chutes to the point of placing.

Plate 5. Placing sidewalk slab.

Forms.—Special care was given to the securing of good form work. The specifications required that the sheathing for all form work should not be less than 1¼ inches thick, sound, straight, accurately matched, and planed smooth on the side next to the concrete. The forms were held rigidly to correct alignment by ample supports and braces, and were so constructed as to permit the side forms of all arches, beams, girders, and columns to be removed for inspection and finishing without disturbing the supports. The absence of warps and buckles upon the surfaces of the finished concrete is doubtless due to the thickness of the sheathing and to the efficiency of the form supports and braces.

Chamfered edges were secured upon all arches, beams, and stringers by means of triangular-shaped stripping nailed inside the forms.

Concrete Materials, Mixing, and Placing.—In general, the specified requirements for concrete materials were those in general use for structures of this character. The crushed granite used in the sidewalk balustrade and electric lighting pedestals was required to be of approved color or colors. In order to secure a uniform surface appearance upon the general structure, the contractor was permitted to use only one brand of cement.

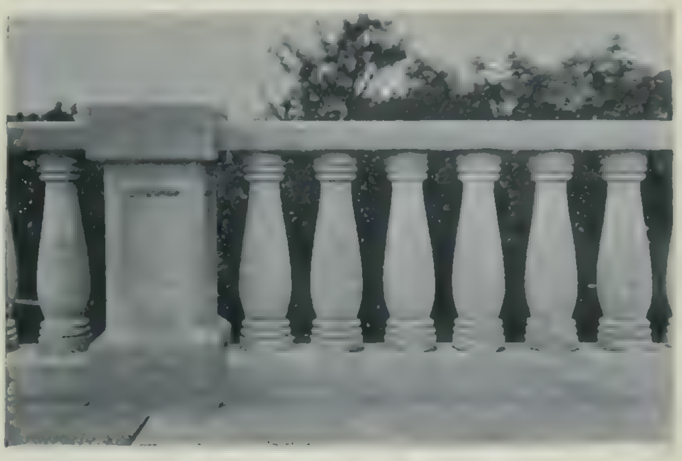
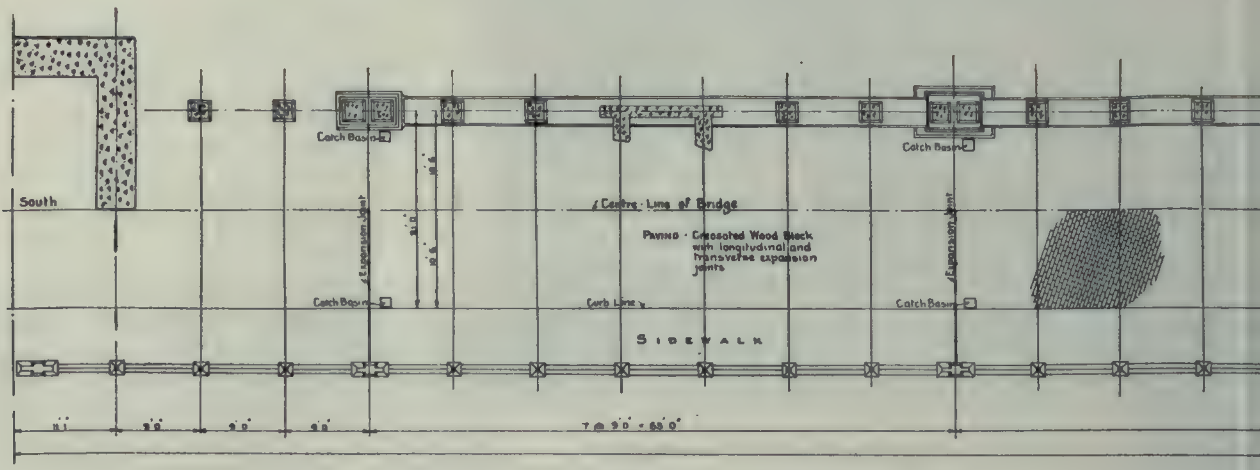


Plate 6.—Completed sidewalk balustrade.

For all superstructure work the concrete proportions were, in general, as follows. (The specifications, however, provide that the sand and stone aggregate must be used in such relative proportions as would ensure concrete of maximum density). For main arches, deck arches, floor system, and sidewalk slabs, except for surface veneer layer of the latter:—one part Portland cement, two parts sand, and four parts broken stone; for sidewalk balustrades, one part Portland cement and two parts crushed granite; for sidewalk surface, one and a half parts Portland cement, half part hydrated lime, and two parts crushed granite screenings.

The aggregates were measured by loose volume, the unit of measurement being the cubic foot. The cement was measured on the basis of weight, 100 pounds being assumed to measure one cubic foot.

The interior of the forms generally being obstructed by the reinforcement, the work of placing the concrete was especially difficult in many parts of the structure. The rate of placing was such that the mixing was more than usually thorough. As a result, the mortar content of the concrete attained a "smooth" and "buttery" consistency well adapted to the securing of desirable exterior surfaces. Perhaps the most



Roadway Plan

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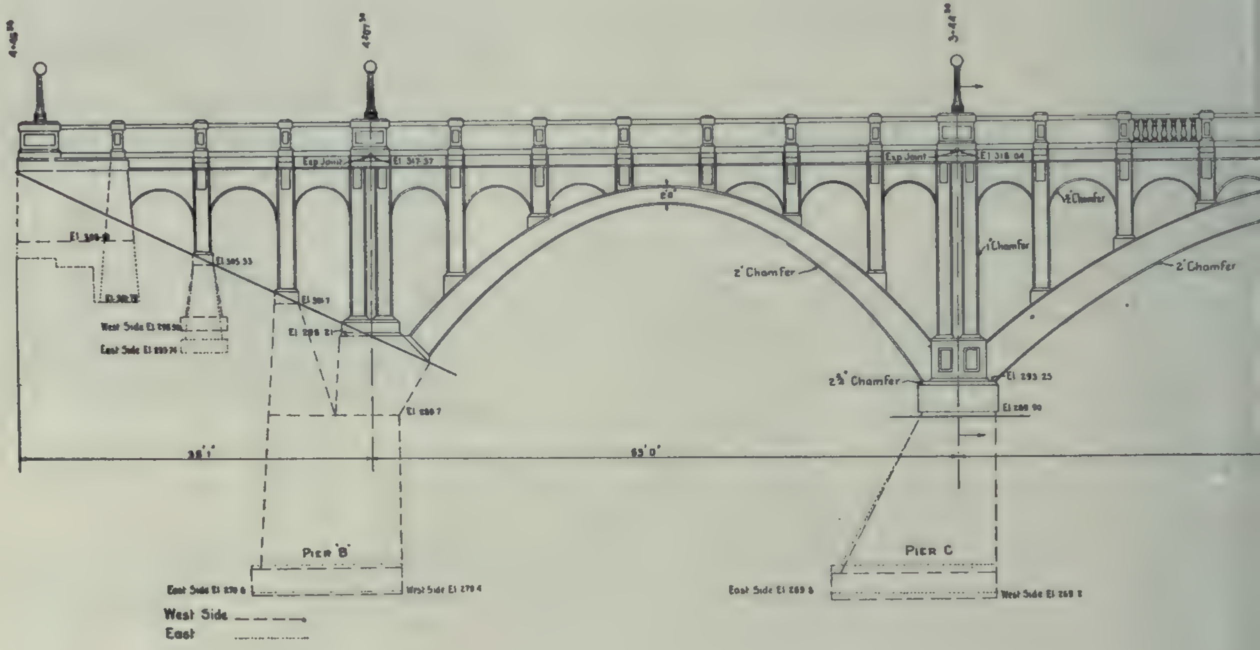
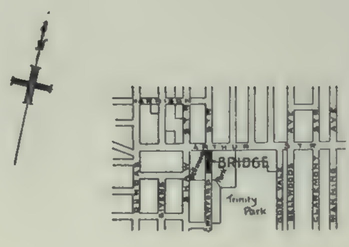
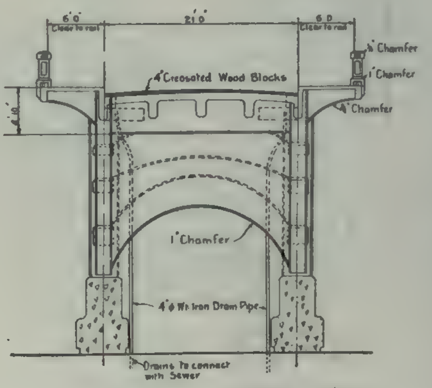
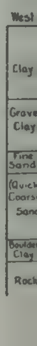


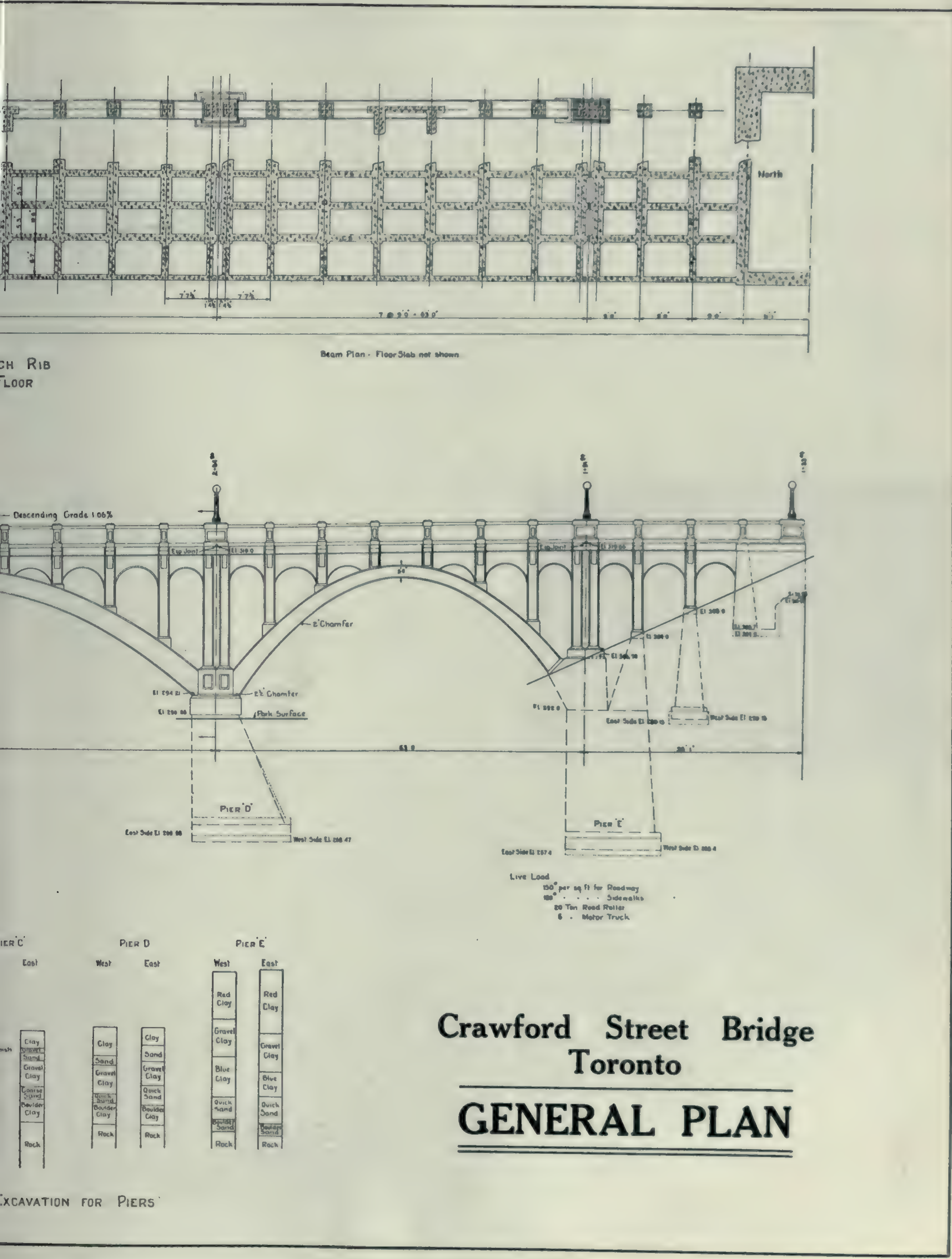


KEY PLAN



SECTION AT $2{\cdot}54^{50}$ & $3{\cdot}44^{50}$.





Crawford Street Bridge
Toronto

GENERAL PLAN

interesting result obtained in this connection is the comparatively small amount of surface "hair cracking" or "crazing" so common upon concrete in which the cement has been flushed to the surface.

All concrete was transferred to the point of placing by means of metal or metal-lined chutes from the buggies already described. These chutes are shown in Plates 3 and 5. The order of placing the concrete in the superstructure forms was as follows:—

1. End sections of 63 ft. and 90 ft. arch ribs, simultaneously.
2. Crown sections of arch ribs, crown floor beams, stringers, and sidewalk brackets, simultaneously.
3. Columns, transverse arches, sidewalk brackets, floor beams, and stringers of first two end panels of 63 ft. and 90 ft. spans, simultaneously.
4. Remaining columns, transverse arches, sidewalk brackets, floor beams, and stringers completing each main span, simultaneously for each span independently.
5. Columns, transverse arches, and stringers of approach spans.
6. Floor slab of 90-ft. span.
7. Floor slab of 63-ft. spans.
8. Sidewalk slabs.
9. Sidewalk balustrade.

Plate 7.—Moulding sidewalk balusters.

The sequence of the work described above was adopted in order to ensure a symmetrical and balanced condition of loading upon the centering, and ultimately upon the main arch ribs, since the concrete in these members had attained a considerable degree of strength from having been in place several days.

The work of placing the concrete was carried on only during daylight hours, and the points for stopping same were fixed at locations where the general strength of the structure was not affected in any way. In general, these locations were as follows:—main arch ribs at sections midway between posts supporting the deck construction; spandrel arches and sidewalk stringers at mid-span; stringers and floor slabs at centre of floor beams; sidewalk slabs at expansion joints.

Expansion Joints.—To provide for expansion and contraction resulting from temperature changes, expansion joints were placed at the ends of the main spans. The details of these joints are shown in Fig. 3.

Sidewalk Balustrade.—The general details of the sidewalk balustrade are shown in Plate 6. In accordance with the specifications, the balusters, top rails, bases, etc., were constructed independently, and required a certain amount of assembling to form the completed balustrade. It is believed that this form of construction is less likely to develop cracks and spalls than the ordinary form of monolithic construction.

The balusters, top rails, and electric lighting pedestals were moulded and finished adjacent to the bridge site. Plate 7 shows this portion of the work in progress. The base pieces were cast and finished in place, after which the portions of the posts below the cap were also cast in place. Following this, the balusters and top rails were assembled, and the caps of posts were cast in place, and the whole post rub-finished. The balusters are held in position by dowels projecting into the base and top rail pieces, which were thoroughly embedded in cement mortar at the time of assembling. In order to render each panel section practically an independent unit the ends of each top rail and base were served with two-ply of asbestos paper, thus rendering it impossible to secure a bond with the concrete composing the posts.

Concrete Finish.—The close proximity of Arthur and Shaw Streets to the bridge site rendered it important that the surface finish of the concrete should be smooth in character in order to reduce to a minimum the surface discoloration resulting from flying dust and other matter. To fulfil this requirement, a so-called "rubbed" finish was specified. This consisted essentially of the following: as soon as the forms were removed all surface air-holes or other cavities were filled with mortar of the same mix as used in the mortar content of the concrete. Following this, the surface of the concrete was thoroughly rubbed with carborundum bricks to remove all inert material and all impression of the timber of forms or other surface irregularities. As a final finish the surfaces so treated were washed with a thin, neat cement wash applied with a whitewash brush, and intended to fill minute surface air-holes. This thin wash when of a proper consistency and applied as described will produce over the entire surface a very thin cement dust which is at first easily removable with the hand or with a brush. This dust possesses the peculiar quality of absorbing within a few days sufficient moisture from the air to give it a final set, thus producing a smooth, firm, blue-gray finish upon the surface of the concrete. This cement wash, when made of a creamy consistency and applied to a concrete surface, will produce a skin coating which almost invariably hair-cracks, and ultimately fails by chipping off.

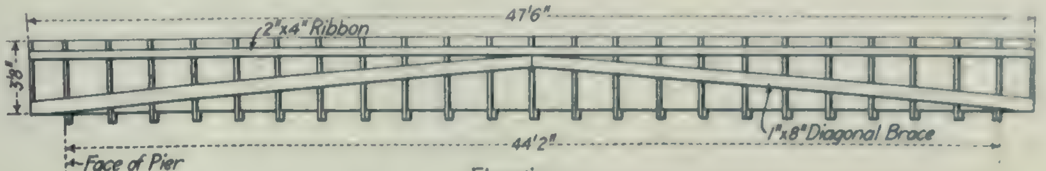
The sections composing the sidewalk balustrade were either lathe-turned or hand-rubbed until all mortar surfacing was removed and the crushed granite aggregate was exposed.

Engineers and Contractors.—The structure was designed by, and constructed under the supervision of, the Railway and Bridge Section of the Toronto Department of Works, of which Mr. R. C. Harris is the Commissioner. The contract was awarded to Messrs. Wilson, Townsend & Saunders, of Toronto, but the main portion of the work was carried out by Mr. C. J. Townsend, successor to this firm. The cement was furnished by Alfred Rogers and John E. Russell, Toronto, the triangular mesh reinforcement by the U. S. Steel Products Company, and the structural steel by the Hamilton Bridge Works.

Forms Built Before Supporting False-work for Concrete Bridge*

IN the construction of a bridge superstructure consisting of long-span girders of reinforced-concrete, it was not desirable to erect the supporting falsework in advance of the girder and slab forms. A form design was worked out which would permit of the entire deck form being temporarily self-supporting. After this was erected, it was used to raise the falsework to support itself till the concrete had set.

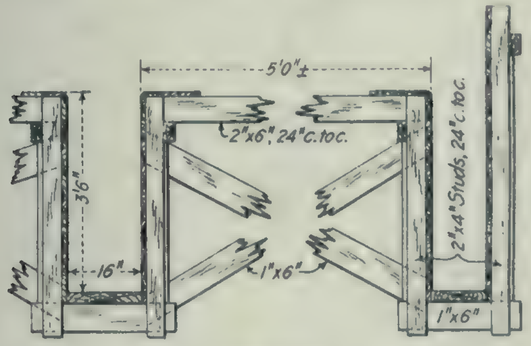
The spans were of various lengths, the longest being 44 ft. 2 ins. clear span and 31 ft. above the ground. The largest girder was of this length with a section of 16 x 42 ins., the form being 47 ft. 6 ins. long with a bearing of 20 ins. on each pier. The type of form is shown in the accompanying sketch. The form sides, consisting of 2 x 4-in. verticals spaced on 24-in. centres, and 1 x 6-in. lagging, were built flat upon the ground in pairs. On the outside face of each was spiked a 2 x 4-in. ribbon to receive the floor joists according to customary practice. In addition, however, there were placed two diagonal braces of 1 x 8-in. plank running from near the middle of the top to the ends of the bottom of the form. These were securely spiked to each stud so that they would be able to resist either compression or tension.



Elevation

Forms raised first, then used to erect own supporting falsework.

In erecting, a pair of sides were placed between piers approximately under their location above, their bottom fastened by means of 1 x 6-in. cleats as shown, the 2-in. girder bottom placed and temporary cleats nailed across the form at the top as spacers, so that the form for the girder was complete on the ground. A portable gin-pole having a hand windlass at its bottom was used for hoisting the form into place. This was done by a line around the middle of the girder form, which placed the diagonals in tension. As the over-all length of the form was greater than the clear distance between piers, the form had to be tilted in raising.



Cross-section.

In building some of the shorter span forms, the 1 x 8-in. diagonals were dispensed with. When all the forms for one span were placed in position the floor joists were placed to tie the deck together, and a single post was put in position under the middle of each girder to take care of the deflection. The diagonal braces between girders were next put in place, which gave the entire superstructure great stiffness.

Just before concreting the span, the supporting posts were erected. This was done by means of a hand-line from the deck. The posts were, for the most part, doubled 2 x 6's with a 4 x 4-in. cap at the top, and were easily handled. When erected they were fastened at the top by a nail through the girder bottom. After all posts were in place the form was brought to exact grade by wedges driven at the bottoms of the posts. The lateral and diagonal braces were then placed on the falsework and the floor lagging placed on the deck. After being wired the forms were ready to receive concrete.

The weight of the largest forms was approximately 1,600 lbs., and when in place they deflected about a foot at the middle. Longer forms than the one shown were handled from the deck. These, however, were for one face of a girder only. The largest of these was 70 ft. long and 5 ft. wide, built of 2 x 4's with 1-in. lagging. They were handled by two small jibs operating at the quarter points, lateral stiffness being given by hand-lines at each end.

The Borough Engineer of Kensington has prepared a scheme to repair roads economically. Much road improvement is necessary, but municipalities will not be able now to secure loans for costly repaving schemes. The Borough Engineer some time ago experimented with a concrete carpet over the macadamized roads, and was delighted to find that it served its purpose admirably. The carpet not only spread the weight of the heavy modern motor vehicle fairly evenly over the foundation of the road, but also did much to absorb shock. Now this process is to be adapted to certain wooden roads which are in bad condition. He proposes to deal with an experimental length of roadway by removing the wood and converting the foundations into a concrete road. The existing foundation will remain, but will be reinforced by a layer of bituminous concrete, over which a wearing surface carpet of concrete will be placed. It is computed that such carpet of concrete will last as long as a completely new road, but the cost will be only one-third of a new road.

Characteristic and costly is the exhibition of civic mismanagement surrounding the construction by the city of Montreal of the new Laurier Ward main sewer, which was to cost $150,000, has already taken $162,600, and requires another $179,940 or a total of $342,540 for completion under oft-revised plans.

"Let each man of us see that we spare nothing, shirk nothing, shrink from nothing, if only we may lend our full weight to the impetus which shall carry to victory the cause of our honour and our freedom."
—Lord Kitchener.

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* By R. C. Hardman, in the Engineering Record.

The Reconstruction of The Hamilton, Ont., Water-Works

SOME three years ago it was found necessary to undertake a complete renewal of the Hamilton, Ont., water-works. The original system was installed in 1859 and had been gradually extended until 1912, when the rapid growth of the city necessitated reconstruction. At the latter date there were four steam pumps in operation having an aggregate daily pumping capacity of 13,500,000 imp. gals. There were three mains to the city of 18, 20 and 30 ins. diameter, respectively. Two of these pumps and the 18-in. force main were installed in 1859 as a part of the original works. These pumps are of the vertical beam plunger type and are now something of a curiosity. They are still in commission for emergency use in the event of interruption to the electrically driven turbine pumps installed during the reconstruction to supplement the pumpage of the other two steam pumps.

Mr. A. F. Macullum, City Engineer of Hamilton, Ont.

Hamilton lies at the westerly end of Lake Ontario where at its extreme end a sand ridge cuts off the lake from Burlington Bay, on the shores of which the city lies. Owing to its location and this sand ridge, through which a short canal is cut to the lake, combined with the fact that most of the sewage from the city is treated at disposal works before entering the bay, it has never been found necessary to treat the water taken by the intakes from Lake Ontario.

In connection with the original installation two intakes extended into the lake—one of cast iron, 20 ins. in diameter, for a distance of 1,000 ft., and the other a wooden box intake 3 ft. square extending into the lake a distance of 300 ft. Each had its inner end in a settling basin from which wooden conduits lead to the wells at the pumping station. It is interesting to note that one of these wooden conduits placed in 1859 was found to be in first class condition after 55 years' service.

It was decided to construct a new intake, 4 ft. in diameter and 2,100 ft. in length, which would bring it to a depth of 32 ft. of water in the lake. This steel intake pipe, including intake piece, sluice valve and expansion joints, cost $20,520 delivered on the site and was riveted in lengths of approximately 140 ft., on the ends of which were flanged pieces. The price mentioned includes also the lead gaskets and bolts.

The accepted bid for laying this pipe was $35,000, which included the building and placing of the intake crib and a concrete valve chamber and house at the settling basin end. As ice ridges formed out in the lake for a distance of about 1,000 ft., and in some places 30 ft. high, it was necessary to protect the pipe to lay it in a trench on the lake bottom so that when filled in again the pipe was covered. Concrete in bags was placed around the pipe for 300 ft. from the shore line as an added precaution. Four piles were driven in the trench in such a position that when a 140-ft. section was floated into position two piles would be at each end of the section. Across the two piles at each end a sill was bolted at grade and the pipe was lowered to rest upon these sills and was there held in position by wooden blocks on either side. A cap was bolted across the two piles over the pipe after the section had been bolted to the preceding section by the divers. Besides securing proper alignment the object in driving these piles was twofold; first, for ease in joining up two sections clear of the sand, and, second, to offset as much as possible the tendency of divers to fail in bolting up the lower sections of the pipes because of difficulty of access. As there was little possibility of scour on account of the method of construction adopted it was not considered necessary to space the piles closer and the above arrangement has proved quite satisfactory.

In an examination of the plans for intake cribs adopted by the cities on the Great Lakes it was found that the minimum size was 40 ft. square and of sufficient height so that the mouth of the intake facing upwards was at least 7 ft. above the bed of the lake. This minimum size I did not consider necessary, but designed the intake crib to be 24 ft. square, placing rip-rap around the outside, and this has since been found quite sufficient. No iron was exposed about the intake opening, but these were constructed with oak plank to prevent the formation of anchor ice. In the gate valve house were placed fish screens for obvious reasons. A reinforced concrete conduit 4 ft. in diameter and 2,000 ft. long was constructed to the large well at the pumping station. This conduit before reaching the pump well passed through a screen chamber through which the two old wooden conduits also passed. At the intake and outlet of each conduit were placed sluice valves so that any conduit could be cut off entirely or in part. Each of the turbine pumps feed from a small and separate well connected with the main well with a gate valve cut-off. By this method any foot valve can be inspected and repaired if necessary without interfering with the water supply of the other pumps.

The New Pumping Plant

In the construction or reconstruction of any water works system the pumping plant is of paramount importance. What power to use, whether steam, gas or electric, will depend principally upon the cost of power delivered on the shaft. Other considerations will be the capital cost of installation, including size of relative buildings, cost of operation, and depreciation. It should also be borne in mind that if the electric power be brought from a distance it will be subject to interruptions and is consequently less reliable than the other agencies mentioned.

In Hamilton on account of the low cost of electric power ($16.50) per annum, it was decided to increase the number of electric driven pumps to meet the future demands and the pumping station for the units already installed was enlarged. Two new electric driven turbine pumps were installed, each of 6,500,000 gals. (Imperial) per 24 hours, or of the same capacity as two units already in operation. There is a steam plant also, having a capacity of 13,500,000 gals. per 24 hours, which is generally held in reserve or to carry the peak load during periods of heavy consumption.

The subject of plunger pumps has been well covered in several text books, but the development of the centrifugal into its present efficiency is less known. This applies not only to the design and construction but also to operation. It is only comparatively recently that this type has been efficiently applied to water works pumping problems. Almost any machine shop or foundry could build a centrifugal pump that would deliver more or less water against a certain head, but little attention was formerly given to efficiency, or to accessibility during operation, everything being sacrificed to low first cost. Most pumping station centrifugal pumps are driven by electric motors and consequently the operating cost is a definite and known quantity and it then becomes a question of getting the maximum efficiency from the pump under the existing conditions.

A centrifugal or turbine pump has certain fixed characteristics. For instance, in a turbine pump operating at constant speed, as it will if driven by synchronous motors, the amount of water pumped increases with the drop of pressure in contra-distinction from the piston pump which always pumps the same quantity of water no matter what the pressure.

If then a turbine pump is designed to deliver a quantity of water through a pipe or a piping system of certain diameters and length at its maximum efficiency and another turbine of exactly the same characteristics is started to pump through the same piping system the frictional head from the delivery piping will increase due to the increased velocity of water through it with the result that the increased head will reduce the individual deliveries, so that the total deliveries from the pumps is equal to twice the delivery of the individual pump at the increased head, instead of twice that of the original pump if pumping by itself. If these two pumps are to work together most of the time the efficiency curve for each pump should be at its maximum over the variations in head between one and two pumps working.

If two turbine pumps deliver into a piping system that decreases the individual delivery of each pump by more than 10 per cent. it will have the tendency to cause the delivery to swing from one pump to the other so that one pump will be delivering water and the other practically churning. This may be remedied by increasing the sizes of the impellers.

It is usual to keep the length of suction tubes of all pumps under 25 ft. and most pumps have suctions not greater than 20 ft. to minimize the possibility of air leakage.

It has been found in a number of cases with turbine pumps that the tips of the impellers wear very rapidly when the suction tube length is greater than 12 ft. With less than this height there is little or no wear. The reason for this wearing is probably imperfections in the design of the turbine pump as built to-day, although some manufacturers guarantee over 80 per cent. efficiency.

The two stage turbine pumps that Hamilton installed at its main pumping station pump against a head of 285 ft. with an efficiency of 75 per cent. under full load. The bids for two 6,500,000-gallon (Imperial) turbine pumps in place varied from $5,500 to $9,800. Extra impellers capable of lifting the water to 300 ft. were included and the pumps had to be successfully operated for two weeks before acceptance.

Booster Station

Besides the main pumping station there was built a booster station to replace steam and air lift pumps and to carry the water to greater elevations than possible with the main pumping station without causing excessive pressures in the lower portion of the city. This station contains four turbine pumps each of 1,000,000 imp. gals. per 24 hours. Two of these pumps raise the water about 80 ft. above the level of the reservoir to which the main station pumps delivered the water and two pumps raise the water 280 ft. above this level. Two stage pumps only were necessary for the lower level below the mountain plateau, but six stage pumps were required for the higher elevation. The problem at this station was to determine approximately the heads to which the pumps would generally work so as to get the greatest efficiency out of them. The pumps were directly connected to the mains fed from the main pumping station and about 75 ft. below the level of the reservoir that the main station fed.

Besides the usual annual and daily fluctuations in head with the added effect of the draft of these pumps on the static head there was the difference in level of two reservoirs on the main system to be considered. One of these reservoirs was only used in case of emergency or while cleaning or repairing the reservoir generally used, but as it was 60 ft. lower in elevation and two miles distant across the city, and nearer the pumping station, it naturally produced considerable variation, and practically made the problem of obtaining maximum efficiency with turbine pumps under all working conditions indeterminate. The pumps as built and operated give a maximum efficiency of 60 per cent., although under certain conditions the specified efficiency of 75 per cent. is obtained. Bids for these four pumps in place varied from $6,000 to $6,800.

The main pumps are driven by 750 h.p. motors, the lower level pumps at the booster station by 50 h.p motors, and the higher level by 130 h.p. motors. All these pumps run at 750 r.p.m.

As stated before there were in commission from the main pumping station three rising mains, 30, 20, and 18 ins. in diameter, respectively. They were connected to the pumps in the usual haphazard way prevalent in many plants in this country. It was decided to build a fourth main 36 ins. in diameter and about equal to the other three mains in discharging capacity. Although nearly two miles of this main had to be built to bring water to the outskirts of the city, along a line already used by the other three mains, it was decided to take a slightly longer route away from this line to avoid the danger of a bad blow-out, putting all the mains out of commission.

The connections from the pumps were carried to a header pipe 4 ft. in diameter running at right angles and at a lower elevation than these connecting pipes.

Between each of the old pipes and the header a gate valve was placed and as the new 36-in. main leaves from the end of the header the whole arrangement proved very flexible in operation. On each of the mains was installed the usual check and gate valve besides the Venturi meter for measuring the discharge.

Caulking Data

Before laying the large main to the city, and other mains throughout the city, tests were made to ascertain the relative efficiency and speed in making poured joints and lead wool joints; also the relative efficiency of joints caulked by pneumatic hammers and by the usual hand method.

It was found that with the pneumatic hammers between four and five poured lead joints could be caulked to every one in which lead wool was used. This difference was due, generally, to the hammers becoming wedged in driving in the lead wool. It was also found that the compression in the caulking went deeper in the poured than in wool joint, thus giving greater density.

Several alternate joints were caulked by the pneumatic hammers and by hand and this section was gradually put under pressure. It was found that every joint caulked by hand commenced to leak slightly at 110 lbs. pressure but that the pneumatic caulked joints remained tight.

To carry the construction of these mains through quickly and efficiently by the city forces an air compressor with pneumatic caulking tools was purchased.

The city had a small steam shovel with a half-yard dipper which did the excavating and also the lifting of the pipe into the trench. A 12-ton dinky engine with cars and track was also purchased and with this equipment (which also did the back filling) as many as 15 36-in. pipe were laid in a day in a trench which had a variable depth but always sufficient to give a top covering over the pipe of 5½ ft. This large main was laid to grade with blowoffs every half mile to the city and having the usual gate and relief valves.

To compare the relative speed of hand and pneumatic caulking, tests were made with the results shown in the following:

Size pipe, ins.	Class.	Depth of lead joint, ins.	Weight of lead used, lbs.	Depth of yarn, ins.	No. of hand caulkers.	No. of joints per day	No. of machine caulkers.	No. of joints per day.
36	C.	3½	121	1	2	4	2	12
30	C.	3	90	1	2	6	2	15

From the above it will be seen that on the 36-in. pipe the machine men caulked three times as many joints as the hand men and 2½ times as many on the 30-in. pipe. Due to many local conditions entering, as, for instance, the filling in of old wooden bridges and the building of concrete culverts, which were charged to the cost of the mains to the city, no cost data are given. The cost of a length of 2,157 ft. of 24-in. main in the city, under normal conditions, with a depth ranging from 7 to 9 ft., averaged $1.86 per foot.

The length in feet of new mains in this reconstruction comprised: 12,900 ft. of 36-in., 13,800 ft. of 30-in., 6,000 ft. of 24-in., 4,600 ft. of 20-in. and 2,500 ft. of 18-in. main. The total cost of this work including intake, conduit, pumping stations and mains was $750,000.

Bank of Commerce Vault Building, Vancouver

In addition to the imposing premises at the south corner of Hastings and Granville Streets, Vancouver, in which the main branch and offices are located, the Canadian Bank of Commerce maintains eight branch offices in other parts of Vancouver. To care for the used ledgers and other records of the main office and branches, which have to be produced from time to time, a safety deposit building is now under construction in Grandview, one block from the bank's Commercial Drive branch, in the eastern section of the city. The building is of reinforced concrete construction, and burned hollow tile will be used extensively in the construction of the walls, floors and partitions.

Progress view—Bank of Commerce Vault Building, Vancouver.

The building, which will be three storeys and basement, with exterior of tapestry brick and cut stone, has been designed by Mr. V. D. Horsburgh, F.R.I.B.A., Toronto, who is represented in Vancouver by Mr. W. F. Gardiner. The design of the reinforced concrete is by Mr. P. Brown, A.M.I.C.E. Messrs. Baynes & Horie, Vancouver, are the contractors.

New Apparatus for Determining Fineness of Cement

Three years' experiments, intended to produce a means of determining the exact fineness of cement, have resulted, at the U. S. Bureau of Standards, in the developing of an apparatus which is effective for this purpose. In the manufacture of Portland cement, clay or shale and limestone are ground together and "burned" in rotary kilns. The cement comes from the kilns in the form of hard, black, semivitreous lumps, or "clinker." When pulverised, this clinker becomes a greyish powder, which is the familiar article of commerce employed for a great variety of purposes in practically every type of building construction.

It has long been known that the fineness to which the cement is ground is one of its most important characteristics, and consequently specifications require that 75 per cent. or more of commercial cement shall pass through a No. 200 sieve, which has 40,000 openings per square inch. This is the practical limit of mechanical sieves in respect to fineness.

It is very important to have some means of measuring directly the entire state of sub-division of cement; in other words, to discover just what percentage of the material is made up of particles of certain definite sizes. If such a division can be made, it should be possible not only to compare the efficiency of different grinders, but also to determine what degree of fineness must be attained before the cement becomes "hydraulically active"—that is, capable of combining with water to form the binding material in mortar and concrete.

The apparatus devised by the Bureau of Standards consists of a vertical brass pipe about 3 in. in diameter and 5 ft. long, at the lower end of which is attached a glass bulb, in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and as the air can escape only through the vertical stack, it carries with it the cement dust, which is caught in a flannel hood surmounting the stack. The air-flow in the stack is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. This residue is weighed, and the amount of dust is determined by subtracting the weight of the residue from that of the original sample of cement. Different grades are obtained by using different-sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standardized without reference to the size of the nozzles and other parts of the apparatus or the air-pressure used.

It is found that the cement "flour"—that is, the portion of cement which contains no perceptible grit when rubbed between the fingers—consists of particles less than 0.007 in. in diameter. The apparatus is called the air analyzer, and may be used for separating and grading hard-grained materials, such as ground quartz, emery, and other abrasives. The air analyzer in modified form is also capable of separating many other powders—for example, paint pigments, plasters, clays, and similar materials.

Modern School Building at Vancouver B. C.

In the October 20, 1915, issue of this journal there appeared a description of the Strathcona School, Vancouver, B. C. We now present another design which has been carried out in the erection of the Beaconsfield School.

The contract for the building was let to the British Columbia Granitoid Contracting Company, Limited, for $58,275, this figure having been exceeded only to the amount of $39.60 for extras. The cement trimmings and dark red facing brick make a striking color combination, the effect being heightened by the slate roof and window trim. The building contains eight class-rooms, two domestic science rooms, library, Principal's room, male and female teachers' rooms with full accommodation, and medical officer's room.

A separate contract for the heating and ventilating plant (Plenum System) was let to the Canadian General Fire Extinguisher Company, Limited, Vancouver, for the sum of $10,000, and on the advice of the Board's heating engineer, Wm. Leek, an auxiliary electrical plant was installed at a cost of $4,466. This permits closing down the steam plant throughout the summer months.

A complete system of inter-communicating telephone service has been installed.

Provision has been made in the arrangement of

Beaconsfield School, Vancouver, B. C.

all necessary pipes, etc., with a view to the enlargement of the building. A concise key plan shows the position of all pipes, both underground and on each floor.

A temporary partition divides the basement into two sections, having separate entrances for boys and girls. This partition can be removed in the event of an extension being added.

The following sub-contractors supplied material for the building: J. Wartman, plastering; Orr Bros., plumbing; Cedar Cove Sash & Door Company, interior trim and cabinet work; B. C. Sheet Metal Works, sheetmetal work; E. A. Lee & Company, painting and decorating; Pacific Glass Company, plain glazing; British Canadian Glass Company, ornamental window; Martin, Finlayson & Mather, hardware; Ne Page-McKinney, electric work; Continental Marble Company, terrazzo floors and tile work; Dominion Iron Works, ornamental iron work; Raecolith Flooring Company, composition floors, halls and stairs; Tuec Vacuum Cleaning Company, vacuum cleaning system; Fess System of Canada, oil burning plant.

Setting Out Arches

IT is a common occurrence to see what would otherwise be a piece of good brickwork marred by the unsymmetrical manner in which the arches to the several door and window openings have been arranged; and where bricks of a different colour from the surrounding work have been employed in turning the arches, the bad appearance is generally intensified.

This want of symmetry, which is confined to arches of the segmental description, is generally attributable to lack of system in planning and setting out, and nothing looks worse than to see the skewbacks cut at all sorts of angles with the horizontal and vertical lines of the brickwork.

Fig. 1 shows an example of arches arranged in haphazard fashion, while Fig. 2 shows the same openings arched over proportionately, both as to curvature and rise, and the skewbacks are all cut to the same angle and to the same mould.

The correct manner of setting out is shown in Fig. 3. First draw the centre line A B, and at right angles to this draw B C, and on this line mark off from B half the span of all the openings, and having fixed the rise of the widest opening, find the radius for striking the arch, by the formula

$$\frac{\frac{1}{2}\text{ span} \times \frac{1}{2}\text{ span}}{\text{rise}} + \text{rise} = \text{diameter, which, divided}$$

by 2, gives the required measurement.

For example, the widest opening shown among the

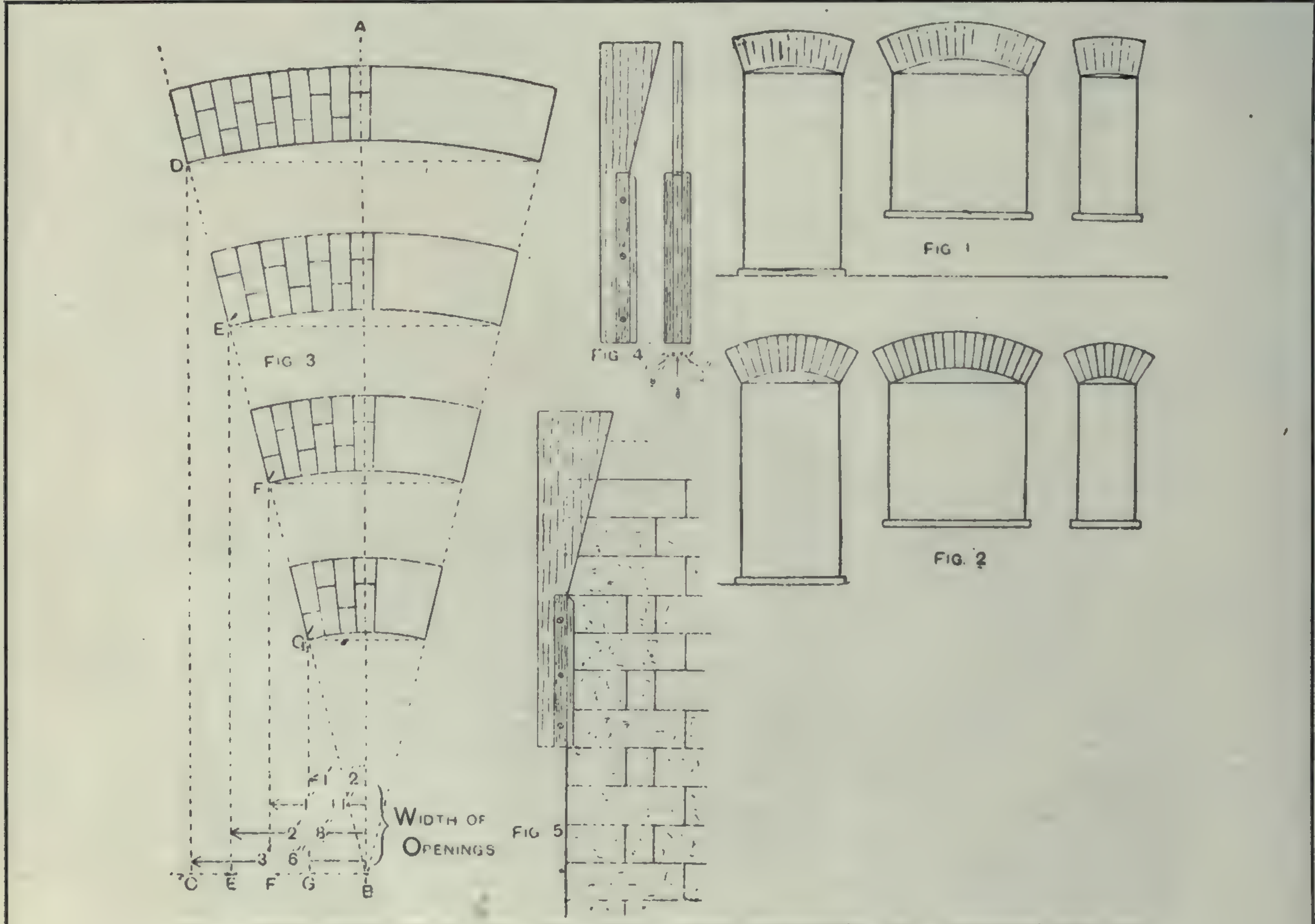

Fig. 1.—Arches arranged without system. Fig. 2.—Arches arranged systematically. Fig. 3.—Methods of setting out. Fig. 4.—Skewback moved. Fig. 5. Method of using mould.

various widths of openings at D in Fig. 3 is 3 feet 6 inches, and the rise being 2½ inches, then the half span is equal to 21 inches; therefore

$$\frac{21 \times 21}{2\frac{1}{2}} = 176\ 2/5 + 2\frac{1}{2} = 178\ 9/10 \div 2 = 89\frac{1}{2} \text{ in.}$$

(approximately) = 7 ft. 5½ in., the radius required. From B as centre, with this radius, draw the soffit curve, and from the point where this arc intersects a line drawn from C, and parallel with the centre line AB, draw a line from B to D, and continue it past the latter point to represent the skewback.

Parallel with the centre line, draw other lines from E, F, and G, until they intersect with the skewback line B D in E′, F′, and G′; then B E′, B F′ and B G′ are the radii of the other openings; the remainder of the setting out is as usual.

A skewback mould, or bevel, is made out of ⅜-in. wood, with a narrow fillet nailed on each side to fit the edge of the jambs so as to be reversible. Fig. 4 shows front and side elevations of this mould, and Fig. 5 shows the method of using it.

The bricks which are to be cut to form the skewback are laid in their places dry, the mould is applied, and the bricks are marked across with the point of a trowel.

THE largest municipal office building in the world is the new Municipal Building of New York City. According to the report of Borough President Marks, the building contains about one thousand offices, which are occupied by over 4,200 city officers and employees. The force employed for cleaning, maintaining and operating the building is under the 8-hr. law and other restrictions, which make it difficult to secure economy. Nevertheless, the estimated annual cost for daily cleaning, watching and attendance for 1915 is only 11.9c. per sq. ft. There is in the entire building 830,000 sq. ft. of floor area. The estimated total cost of operation and maintenance for 1915, including heating, lighting and elevator service, is 29¾c. per sq. ft. of floor area and 49c. per sq. ft. of office area.

A pavement of 2 x 4-in. timbers is the unique feature of an automobile speedway recently completed near the city of Chicago. The track, which is at Maywood, Ill., is two miles long, and consists of two parallel straight sections connected by curves at the ends. The track is about 65 ft. wide on the tangents and 75 ft. on the turns, which are banked to a maximum of 25 ft. The track is supported on timber trestling, the track proper resting on 2 x 12-in. joists. The flooring or pavement consists of 2 x 4-in. tamarack timbers, placed on edge longitudinally of the course. The timbers are about 16 ft. in length and lap about 2 ft. at the ends and are spiked together at intervals.

All bent bars shown in reinforced concrete drawings should be given some reference mark, which should consist of capital letters and numerals, or numerals only. The following scheme is suggested: For the first ⅜-in. bent bar mark it 300, the second 301, and so on, mark the first ½-in. bent bar 400, and so on. For ⅝-in. bent bars use 500, ¾-in. use 600, and so on. The hundredth figure will indicate at once whether the bar is a ⅜-in. bar or a ⅞-in. bar; thus 703 would indicate that ⅞-in. bars are to be bent and probably it is the fourth in the series of ⅞-in. bars having different bends.

Personal Mention

Mr. Frank Chappell, Town Engineer of Oshawa, has resigned his appointment to accept a position with the McLaughlin Motor Company.

F. L. Fellowes, City Engineer of Vancouver, B. C., has been making steady recovery from the illness which necessitated his absence from the City Hall for some little time recently.

William Snider, the first Commissioner of Roads in British Columbia, died last week at his home in Vancouver. The late Mr. Snider was born near Aurora, Ont., seventy-five years ago.

A former member of the Port Arthur City Engineering staff, Mr. T. Pritchard, died at his home in Twickenham, London, England, last month after a few days' illness from pneumonia. The late Mr. Pritchard, whose wife and family reside at Port Arthur, was in his fifty-third year. He was regarded as one of the best qualified hydraulic experts in Eastern Canada.

Pro Patria

LIEUT. JOHN R. GRANT, of the Royal Engineers, was born at Chesley, Ont., and was educated at Queen's University, from which in 1903 he graduated with the degree of B.Sc. He adopted structural steel designing as his specialty, and became identified in turn with the Hamilton Bridge Company, the Canadian Bridge Company, and the American Bridge Company. In February, 1911, he went to Vancouver, B. C., as partner in the firm of Cartwright, Matheson & Company, in charge of bridge and structural steel work. While with this firm he designed the steel work of many large buildings and several bridges in Vancouver and Victoria. Of the bridges, mention may be made of the 330-ft. span suspension bridge over the Kootenay River at Brilliant, B. C. The bridge was built under Mr. Grant's supervision for the Doukhobour Society, which supplied all the labour required in its erection. Soon after the war broke out Mr. Grant went to England and offered his services to the Royal Engineers, with whom he obtained a commission. He spent some months at home, and went on active service "somewhere in France" in due course. While in Vancouver Mr. Grant took an active interest in the Vancouver Branch of the Canadian Society of Civil Engineers, of which he was Secretary the year previous to his departure. Mr. Grant is a Member of

Lieut. John R. Grant.

the Canadian Society of Civil Engineers, and an Associate Member of the American Society of Civil Engineers.

Mr. A. J. Gayfer has been appointed Division Engineer of the Lake Superior district of the Canadian Northern Railway, with office at Capreol, Ont.

Mr. G. P. MacLaren has been appointed Division Engineer of the Toronto district of the Canadian Northern Railway, with headquarters at Rosedale.

Mr. J. D. Evans, formerly Division Engineer for the Canadian Northern Railway at Trenton, Ont., has been appointed Supervisor of Bridges and Buildings.

The following officers were elected at the annual meeting of the Saskatchewan Architects' Association held recently in Regina: President, W. G. Van Egmond, Regina; First Vice-President, R. M. Thompson, Saskatoon; Second Vice-President, A. G. Creighton, Prince Albert; Secretary-Treasurer, F. W. Knight, Regina. Members of the Executive Committee: Prof. A. R. Greig, Saskatoon; R. G. Bunyard, Moose Jaw; and H. Cooper, Saskatoon. Examining Board: Prof. A. R. Greig, Saskatoon; A. G. Creighton, Prince Albert; W. G. Van Egmond, Regina; H. Cooper, Saskatoon; and R. M. Thompson, Saskatoon.

Book Reviews

Elements of Highway Engineering, by Arthur H. Blanchard, C.E., Professor in Charge of the Graduate Course in Highway Engineering in Columbia University. Published by John Wiley & Sons, Inc., New York City.—This book has been prepared as a manual of highway engineering, designed to cover the requirements of a six-months' course. The author is well known as one of the most prominent highway engineers in the United States. For years he has contributed to the leading technical journals. Each chapter of the book has been written with a view to emphasizing the fundamental principles which have been evolved from past experience as well as from the modern practice of highway engineering which, as a science and an art, is rapidly developing in the fields of economics, administration, legislation, materials, and methods. Specifications, per se, examples of construction, and detailed cost data have been omitted, as such material is not considered essential to a broad general knowledge of the science of highway engineering. The text of the chapters, occupying 450 pages, has been profusely illustrated with 202 figures, equivalent in space to 85 pages.

Irrigation Practice and Engineering; Vol. 1, Use of Irrigation Water and Irrigation Practice; by B. A. Etcheverry, head of the Department of Irrigation in the University of California. Published by the McGraw-Hill Book Company, Inc., New York City. Price $2.00 net.—In this book the author has endeavoured to meet the requirements of engineers engaged in irrigation work and of managers and superintendents of irrigation systems. Chapters 1 and 2 deal with the relation of soil moisture to plant growth, and the disposal of irrigation water applied to the soil. Chapters 3 and 4 present the best available information and results, obtained by investigations, experiments, and measurements on the quantity of irrigation water and the time of application to give the most economic use of water in the production of crops. Chapter 5, on the duty of water, defines the units of measurement of irrigation water, and presents the water consumption in typical irrigated districts and on several projects in each of the arid States. Chapter 6 describes the methods of preparing land for irrigation and the methods of applying water to the land. In Chapter 7, on farm ditches and structures, the author has attempted to confine himself to ditches and structures used for the conveyance and distribution of water on the farm as different from those pertaining to the distribution system of the project which conveys and delivers the water to each farm. Chapter 8 deals with small pumping plants, and is limited to a consideration of the types of installation, the conditions for which each type is best adapted, the cost of installation, and the annual cost of operation and maintenance. The main part of the book, to which this volume is introductory, considers in greater detail than has heretofore been done in books on irrigation engineering the principles of design of canals, and structures pertaining to an irrigation system. To make the book of greater value as a reference book for practising engineers, each type of structure is illustrated by well-selected examples, accompanied in many cases by cost data, and methods of construction of special value in irrigation work are described.

Mainly Constructional

East and West—From Coast to Coast

A laboratory for testing building materials has been installed in the department of the Toronto City Architect, Mr. W. W. Pearse.

The Renown Engine and Machine Company is a new Montreal concern organized by L. H. Boyd, A. R. Johnson, and other local men, with a capital stock of $50,000.

The Ladies' Board of the Western Hospital, Toronto, are planning to raise $100,000 for the erection of a memorial building to be known as the Edith Cavell Nurses Home.

The Lachance Nut Lock Company, Limited, Montreal, Que., has been incorporated with a capital of $300,000. The incorporators include J. A. Bilodeau and J. E. Moranville, both of Montreal.

A report submitted to the Board of Control at London, Ont., last week by the City Engineer, Mr. H. A. Brazier, showed that the expenditure on local improvements this year had been $147,175.

"How High Explosive Shells Are Made" was the subject of a smoker talk by Mr. S. B. Chadsey, B.A.Sc., on the evening of the 29th ult. at the headquarters of the Engineers' Club of Toronto.

The Neely Rotary Engine Company of Canada, Limited, has been incorporated by W. F. Neely, John Whitfield, and others, of Toronto. The capital stock is $200,000. The head office will be in Toronto.

The contract for the Ste. Agathe des Monts, P. Q., sewage system has been awarded to Mr. Leon Beauchamp, of Ste. Agathe des Monts, at $70,000. The engineers are Messrs. Ouimet & Lesage, Montreal.

The Canadian Gahagan Construction Company, Limited, capitalized at $100,000, has been incorporated with head office at Toronto. The incorporators include J. S. Denison, F. J. Foley, and others, of Toronto.

The Robert Hicks Company, Limited, Peterborough, Ont., capitalized at $50,000, has been incorporated by Robert Hicks and others of Peterborough to manufacture and deal in building supplies and carry on a contracting business.

Montreal is the head office of the newly organized Premier Granite and Sand Company, Limited, which is capitalized at $75,000. The incorporators are Thomas Scott, of Notre Dame de Grace, J. E. Moranville, J. J. Trickey, and others, of Montreal.

Part of the new hydro-electric plant of the Laurentide Company, Grand'Mere, is now in operation, and men are engaged in day and night shifts completing the work. The plant will develop 125,000 h.p., the main portion of which will be sold to a new company, the Laurentide Power Company, which has a capital of ten million dollars.

John Miller & Son, contractors, Toronto, have obtained judgment for $517, and costs amounting to $544, in a suit against the trustees of the Port Credit Methodist Church. The trustees counterclaimed $2,773, the difference between the estimated cost of $4,500 and the actual cost of $7,273.

The Sarnia Metal Products Company has received from the British Government a war contract which amounts to a large figure, and which will keep the plant working day and night from now until next July. New machinery to the value of $37,000 has been purchased, and as soon as it is installed work will be carried on continuously. The contract is for parts of shells.

Missisquoi Marbles, Limited, New Birks Building, Montreal, have nearly completed the marble dadoes, floors and counters for the new Stanford Market, Mansfield Street, Montreal, and are about to commence work on a contract for the St. Denis Theatre, Montreal, where the company's product is to be used throughout the building. Missisquoi marble is also being set in the corridors, stairs, floors, and toilets of the new Customs Building, Ottawa.

According to a Vancouver despatch, Messrs. Foley Bros., Welch & Stewart are to be sued by Messrs. McIlwee & Sons for $800,000 damages for the cancellation of their contract to bore the pioneer and centre heading tunnels at Rogers Pass. It is stated that the rock, instead of getting harder, has become softer as the gangs have got further into the mountain. The $800,000 is for lost profits and bonus, the bore having proved to be much easier than was anticipated.

At Regina, Wells Brothers Company, Chicago, have already begun work on the footings for a second warehouse to be the same size and character as the Robert Simpson building now nearing completion. It is not intended to erect a second building immediately, but ample provision is made to have it ready as soon as the requirements of business justify it. Wells Bros. Company have 250 men working on the present building, and sub-contractors have an additional twenty-five men engaged.

The Council of the Montreal Board of Trade have endorsed the request of the Canadian Society of Civil Engineers that the city obtain a report from an independent board of engineers on the aqueduct project. The chief objection is to the construction of a hydro-electric plant, the cost of which is uncertain and the economic value, to say the least, problematical. Some experts are of opinion that it will prove a great burden to the city, and before the expenditure of further money, it is asked that the whole plan be investigated.

The development and construction of the hydro-electric plant of the Cedars Rapids Power and Manufacturing Company is to be the subject of papers to be read at the meetings of the Canadian Society of Civil Engineers, Montreal. The first paper, by Mr. Henry Holgate, on the general features of the project, was read at the meeting of the Society on Thursday last. Mr. Julian C. Smith, vice-president of the Shawinigan Company, and Mr. R. M. Wilson, electrical engineer of the Montreal Light, Heat and Power Company, will contribute the other papers.

A new company has been organized in Montreal for the manufacture of steel products on an extensive scale, including shells, which will be known under the firm name of the Standard Steel Company, Limited. The president is Mr. E. G. Jackson, vice-president, Mr. F. E. Smith, and the secretary-treasurer Mr. J. W. Waddell. The head offices are at 1025 Transportation Building, and the works will be at the corner of Atlantic Avenue and Hutchison Street. The company are commencing operations in a building already in existence, and an extension is contemplated probably at an early date.

Some of the directors of the Montreal Builders' Exchange recently met Mr. Churchill, of the Canadian Credit Men's Association, who suggested co-operation in securing more uniformity in the commercial laws of the province of Quebec. Mr. Churchill complained of the delay in the decision of cases and of certain laws which were oppressive to traders. He was in favour of commercial courts, with judges conversant with commercial law and business training. The Association is trying to form a large committee, and the Exchange committee are in favour of being represented thereon.

An enthusiastic recruiting meeting was held in the Montreal Builders' Exchange, on October 27, under the presidency of Mr. John Quinlan. Speeches were made by Controller Ainey, Mr. R. J. Younge and Captain Brown of the Citizens' Recruiting Association, besides members of the association. "Before you go on with what has been your daily work," said Captain Brown, "before you begin again to spend your money and your time on your building business, stop and ask whether your first job to be cleaned out of the way, so that you may do your business in peace and comfort, is not to give your time, as well as your money, to the ending of this horror of war." Mr. William Ramsay, in proposing a vote of thanks to the speakers, and Mr. R. J. McCauley, in seconding the motion, offered the recruiting association every facility to approach all their employees and every assistance in the work. Mr. William Hood, a former president of the Exchange, said he felt sure that many of those present were prepared to make their business a secondary consideration during the period of the war. Speaking along similar lines, Mr. W. E. Potter said that of the small staff employed by him, five had enlisted for active service.

From the Ball Engine Company we have received a copy of their Bulletin S-12, devoted to Erie Revolving Shovels. This bulletin is a revised and enlarged edition of Bulletin S-10. It is augmented by a description of the Erie handling sewer trench work, the machine being equipped with a 32-ft. locomotive crane type boom for handling clam shell buckets. This equipment has proved very satisfactory for this special class of work.

In the article "Highway Improvement in Quebec," published in our issue of October 27, mention might have been made of the fact that the laying of five and one-quarter miles of Rocmac road on the Montreal-Quebec Highway between Yamachiche and Louiseville had just been completed by G. Michaud, contractor, of Three Rivers, Que. Last year Mr. Michaud put down 52,000 square yards of Rocmac in Three Rivers. This year these streets are in perfect condition.

Clay Products Men Meet in Toronto

ANNOUNCEMENT is made that the Fourteenth Annual Convention of the Canadian National Clay Products Association will be held at the King Edward Hotel, Toronto, January 18th to 20th next. The President of this Association is Mr. J. Edward Frid, of Hamilton, and the Secretary is Mr. Gordon C. Keith, of 32 Colborne Street, Toronto. A cordial invitation is extended to all clay products men to be present at the meeting. It is hoped and expected this convention will be the largest in the history of the Association. With this in view the Executive and Entertainment Committee have arranged an excellent programme of addresses, papers, discussions, and social functions.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Brockville, Ont.
The Town Council have decided to lay tarvia roadways on a number of streets. Work will be done by day labor under supervision of the Engineer, G. H. Bryson. Approximate cost, $14,000.

Esquimalt, B. C.
The Municipal Council are making property arrangements preparatory to the construction of sewers in the Fourth Section. Tenders will be called later. Engineer, C. A. Toff, 211 Pemberton Block, Victoria.

London, Ont.
Work is about to start on the construction of a 10-inch watermain on Carling Street for the City Council.

The City Council have decided to lay an asphalt pavement on Rectory Street. Work will commence as soon as possible. Engineer, H. A. Brazier.

The Utilities Commission contemplate laying piping to additional wells and springs and the installation of pumps in order to extend the water collecting system. City Clerk, S. Baker.

Tenders will be received until 10 a.m., November 12th, by the City Clerk, S. Baker, for the construction of about 5,000 feet of sanitary sewer, 8 in.-12 in. Plans at office of the Engineer, H. A. Brazier.

Petrolia, Ont.
Plans are being prepared by Willis Chipman, Mail Building, Toronto, for a new sewer to replace the outlets which have collapsed. Town Clerk, J. McHattie.

Saanich, B. C.
Work will start shortly on the construction of sidewalks in the Gorge District for the Municipality. Engineer, D. W. Johnston, Royal Oak.

Stratford, Ont.
The City Council intend to lay sewers on Front and High Streets and on Railway Avenue by day labor. Engineer, A. B. Manson.

Toronto, Ont.
The Board of Control will receive tenders until November 23rd for the construction of sewers on ten streets. Plans and specifications at office of the Works Department, City Hall.

CONTRACTS AWARDED

Leamington, Ont.
The Town Council have awarded the contract for the construction of a sewer on Talbot Street to Commissioner of Works A. Smith.

London, Ont.
The contract for laying an asphalt pavement on Ardavan Place for the City Council has been let to the Standard Paving Company, Central Chambers, Ottawa.

Toronto, Ont.
The Board of Control have let the contract for the supply and installation of stop valves and other mechanism at the Main pumping station to Drummond McCall & Company, 373 Front Street E., at $9,530.

Railroads, Bridges and Wharves

Alberta Province
The Grand Trunk Railway Company, Montreal, have been authorized to construct a railway spur for the Great West Coal Company, Ltd., in the N. E. quarter of Section 6 and the S. E. quarter of Section 7-53-23, W. 4 M. District, North Alberta.

Moncton, N. B.
The Department of Railways and Canals, Ottawa, intend to complete that portion of the St. John & Quebec Railway between Georgetown and Centerville. Minister, Hon. F. Cochrane, Ottawa.

North Toronto, Ont.
The Canadian Pacific Railway Company, Montreal, have been authorized to construct a siding for the Corrugated Paper Company, Ltd., North Toronto.

Port Credit, Ont.
The Grand Trunk Railway Company, Montreal, have been authorized to construct sidings and spurs across a number of highways in the village to the premises of the Port Credit Land Company, Ltd., which have been leased by the Toronto-Hamilton Highway Commission.

Windsor Mills, Que.
The Town Council are negotiating with the Provincial Government for the erection of a steel bridge, estimated to cost $6,000. Mayor, D. McCarthy.

CONTRACTS AWARDED

New Brunswick Province
The Department of Railways and Canals, Ottawa, have let the contract for the construction of concrete abutments for a number of bridges in the Fredericton Sub-division of the Intercolonial Railway to R. C. Sutherland, 339 Chapel Street, Ottawa.

Vancouver, B. C.
MacKenzie-Mann & Company, Ltd., 719 Metropolitan Building, Vancouver, have awarded the contract for the construction of a reinforced concrete sea wall at False Creek to A. W. Creelman Company, 1651 Laurier Avenue, Vancouver. Work will start as soon as the contractors can assemble their plant.

Public Buildings, Churches and Schools

Bassano, Alta.
Tenders on the installation of fittings at the Post Office will be received until 4 p.m., November 22nd, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications with P. J. Dewie, Public Building, Bassano, L. Dowler, Architect, Calgary, at the Post Office, Brandon, Man., and at the Department. Specifications only at office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

New Glasgow, N. S.
Tenders are being received for the erection of an eight-roomed brick school for the congregation of St. John Roman Catholic Church. Priest, Rev. John McLeod.

Renfrew, Ont.
The Board of Education are considering the erection of a collegiate institute, and are preparing to submit the matter to the Council. Chairman, J. McN. Austin.

Strathroy, Ont.
The Strathroy Hospital Board contemplate equipping the building with fire escapes. Chairman, L. H. Dampier.

Victoria, B. C.
The City Council will call for tenders shortly on the installation of a vault at the City Clerk's Office. Engineer, C. H. Rust.

CONTRACTS AWARDED

Cartierville, Que.
The general contract for the erection of a church on Main Street for the Roman Catholic Congregation has been awarded to Plouffe, Lagace & Company, Bord-a-Plouffe, Que. ... ...

Fort William, Ont.
The Provincial Department of Public Works, Toronto, have let the contract for painting at the Registry Office now in course of erection to A. Churcher, 400 Harold Street N., and electrical work to F. S. Jones, 228 May Street S.

Halifax, N. S.
The general, carpentry, roofing and plastering contracts for the erection of a church at Windsor and Almond Streets for the Evangelical Lutheran Congregation have been let to A. A. McDonald, Imperial Oil Company Wharf, Water Street. Painting, heating, plumbing and wiring will be sub-let. Approximate cost, $6,500.

Kamouraska, Que.
The contract for interior trimming at the Parish Church has been let to Paquet & Godbout, 21 William Street, St. Hyacinthe. Work has been started. Approximate cost, $25,000.

Montreal, Que.
Work has been started on the erection of a school on Hamilton Street for the Protestant Board of School Commissioners. The general and carpentry contracts have been let to William Evely, 449 Bleury Street, the contract for concrete foundation and brick work to Gray

& Wighton, 244 Pine Street W., and the painting to Taylor & Kirby, rear 449 Bleury Street. Approximate cost, $15,000.

In connection with the school now being built on Hochelaga Street for the Protestant School Commissioners, the general contract and concrete work have been awarded to the Deakin Construction Company, Ltd., 37 Major Street, and the mill work to William Rutherford & Sons Company, Ltd., 425 Atwater Ave. Estimated cost, $15,000.

Port Colborne, Ont.
In connection with the school now in course of erection, the contract for painting has been let to W. J. Guinter, Port Colborne, the heating to A. D. Cross, West Street, and the plumbing to S. P. Gourlay, 20 Cross Street, Welland.

The contract for heating at the school now in course of erection has been let to F. Croft, Port Colborne.

Port Rowan, Ont.
Plans are being prepared for a garage and repair shop to be erected for F. Taylor, Simcoe, Ont. White brick construction, cement floors. Work will start shortly.

Victoria, B. C.
The contract for sheet metal work, galvanized iron, windows, shutters and doors in connection with the Observatory in course of erection on Little Saanich Mountain has been let to the British Columbia Sheet Metal Works, Ltd., 1238 Seymour Street, Vancouver.

Business Buildings and Industrial Plants

Alert Bay, B. C.
The British Columbia Packers Association, 517 Granville Street, Vancouver, are considering the erection of a cannery, at an approximate cost of $20,000. Work will probably start about the beginning of next year.

Minto Township, Ont.
John Darroch, Concession 2, Mount Forest, Ont., intends to rebuild his barn hich was recently destroyed by fire. Fireproof construction. Approximate cost, $3,500.

Montreal, Que.
The Standard Steel Company, Ltd., 1025 Transportation Building, are considering the erection of an addition to their plant at Atlantic and Hutchinson Streets. Secretary, J. W. Waddell.

Nelson, N. B.
Fraser, Ltd., Carlton Street, Fredericton, N. B., intend to erect a large sawmill on the Lynch property. Work will start as soon as possible. Approximate cost, $100,000.

Petrolia, Ont.
Fred Howlett, Shuttleworth Tile Yard, Petrolia, has purchased a site and intends to erect a brick and tile manufacturing plant.

Prescott, Ont.
The Newell Manufacturing Company, Patterson Street, Ogdensburg, N. Y., are considering the purchase and enlargement of premises for factory purposes. A by-law to exempt the company from taxation will be submitted to the ratepayers on November 15th. Town Clerk, George Rook.

Quebec, Que.
The Quebec Abattoir Company are having plans prepared for an abattoir. Secretary, Thomas Vien, 72½ St. Pierre Street.

St. John's, Que.
N. J. Gregoire is considering the erection of a theatre on Richelieu Street, but has not definitely decided to go ahead with the work.

Toronto, Ont.
J. W. Clare, 68 Ascot Avenue, has commenced the erection of a store and residence on Dufferin Street, estimated to cost $3,000. Smaller trades will be let. Brick construction.

Tenders will be received until noon, November 15th, by Clinton & Russell, 309 Dominion Bank Building, for the erection of an office building at Church and Court Streets for the Imperial Oil Company, 311 Dominion Bank Building. Steel frame and terra cotta construction, limestone facing, fireproof interior. Approximate cost, $350,000.

Wellington, Ont.
L. K. Shourds intends to rebuild his evaporator, which was recently destroyed by fire. Work will start in the spring. Approximate cost, $5,000.

CONTRACTS AWARDED

Barrie, Ont.
Work has started on the erection of a barn for J. S. Brown, Burton Farm. The contract for cement work has been let to T. Tooke, 30 Grove Street, Barrie.

Glencoe, Ont.
McPherson & Clarke, McRae, Street, are building a garage for William McCallum. Brick construction, Brantford roofing, cement floors. Approximate cost, $3,500.

Hamilton, Ont.
The contract for heating and plumbing in connection with the lodge hall which has been built for Thomas Gould, 236 James Street N., has been awarded to J. Allen, Barton and Emerald Streets, and electrical work to E. A. Wark Electric Company, John Street N.

The general and masonry contracts for the erection of stores and apartments for Thomas Gould, 236 James Street N., have been awarded to S. Howard, 231 Mary Street. Brick construction, stone foundation, felt and gravel roofing. Estimated cost, $6,000.

Toronto, Ont.
Work is progressing on the erection of a brass foundry for Canadian Hanson & Van Winkle Company, Ltd., Morrow Avenue. The general contractor is R. C. Roundell, 206 Indian Grove. Brick construction. Approximate cost, $5,000.

The contract for the installation of an ammonia rectifier and oil trap system at the Civic Abattoir has been awarded to the Linde Canadian Refrigerator Company, Ltd.

Walter Davidson & Company, Ltd., 188 Duke Street, have commenced the erection of an addition to the premises of the New Method Laundry, Ltd., 2 River Street. Approximate cost, $4,300. Brick construction.

Vancouver, B. C.
The sub-contract for roofing, kalamein doors, copper work and metal windows at the new Merchants Bank, Granville and Pender Streets, has been awarded to the British Columbia Sheet Metal Works, Ltd., 1238 Seymour Street, Vancouver.

Windsor, Ont.
The contract for carpentry, plastering and painting required in remodelling a store on Sandwich Street for W. T. Bartlet, Davis Building, has been let to Urgel Jacques, 160 Dougall Street.

Yarmouth, N. S.
The general contract for the erection of a station for the Halifax & South Western Railway Company has been let to J. H. Hicks & Sons, Bridgetown, N. S.

Yorkton, Sask.
In connection with the station being built on Seventh Avenue for the Canadian Northern Railway Company, the general, carpentry, roofing, plastering, heating and plumbing contracts have been let to J. Duncan, 98 Monck Avenue, Winnipeg, and the painting contract to A. McDonald. Terra cotta and brick construction, concrete foundation, asbestos roofing. Estimated cost, $10,000.

Residences

Lawrencetown, N. S.
J. C. Archibald is considering the erection of a frame residence to cost about $3,000.

Levis, Que.
A. A. Falardeau, 46 Cote du Passage Street, is considering the erection of a residence.

London, Ont.
W. R. Bacon, R. R. No. 6, London, has commenced the erection of two residences, estimated to cost $3,500. Frame and white brick veneer construction, concrete foundation, shingle roofing.

H. Templeman, Windsor Ave., South London, has commenced the erection of a residence, estimated to cost $3,000. White brick construction, concrete foundation, shingle roofing.

H. W. Magee, 427 William Street, is about to start work on the erection of a residence, estimated to cost $4,500. Red pressed brick construction, concrete foundation, shingle roofing.

Montreal, Que.
Work has been started by O. St. Denis, 973 Juliette Street, on the erection of three flats on Beaulieu Street. Brick construction, felt and gravel roofing. Estimated cost, $4,000.

In connection with the store and residence which are being built on St. Denis Street for Mrs. E. LeCavalier, 65 Cherrier Street, the contract for roofing has been awarded to Lavigueur & Menard, 2483 St. Lawrence Street, and the plastering contract to O. Houle, 577 Drolet Street.

In connection with the repairs now being carried out at the Princess Theatre, St. Catherine Street W., the general and carpentry contracts have been let to Anglins, Ltd., 65 Victoria Street, the contract for steel to Structural Steel Company, Ltd., 10 Cathcart Street, and the decorating, painting, etc., to W. Eckart & Company, New York.

The Modern Construction Company, Ltd., 2950 de St. Valier Street, have commenced the erection of eight flats, estimated to cost $12,000. Brick con-

(Continued on page 47)

Tenders and For Sale Department

DRUMMONDVILLE, QUE.

Capitalists Builders

To accommodate large increase in local population (200) two hundred dwelling houses are immediately required. Splendid investment, rents running from $20 to $30 per month. To induce immediate building, plans and specifications for houses will be furnished free on application to

W. A. MOISAN,
43-45 Town Clerk.

Tenders Wanted

The Toronto Electric Commissioners will be glad to receive tenders for overhead line construction work. Particulars may be obtained on application to the Purchasing or Engineering Departments, 15 Wilton Avenue. Tenders must be addressed to the Chairman, sealed and endorsed "Tenders for Overhead Line Construction Work," to be delivered as soon as possible. The lowest or any tender not necessarily accepted. 45

FOR SALE
Travelling Derrick

Timbers 14 in. x 14 in., 70 ft. boom, 30 ft. mast, also 10 x 12 D.C. 3 Drum Lidgerwood Engine and upright boiler attached with 5½ x 7 separate swinging engine. All in A1 condition. Cheap for quick sale. Apply Box 354, Welland, Ont. 45

Tenders for Smoke Breeching

Tenders will be received by Registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clock noon **on Tuesday, November 23rd, 1915**, for the construction and erection of

Smoke Breeching at Main Pumping Station

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
45 Chairman, Board of Control.

OSHAWA, ONT.

Town Engineer

Applications will be received up to November 20, 1915, by the Town Clerk, for the position of Town Engineer and Superintendent of Waterworks. Letters must state full particulars of professional experience, age, salary required, etc.

W. E. N. SINCLAIR, B.A., LL.B.,
Mayor.
THOS. MORRIS, Town Clerk. 44-45

Tenders Wanted

Separate and bulk tenders will be received for a new four-room school, Section 33, York Township, until **November 22nd.**

Lowest or any tender not necessarily accepted. Plans, specifications and tender forms may be had at the office of

S. B. COON & SON, Architects,
45 409 Ryrie Building, Toronto.

Late News Items

Bridgeford, Sask.
The Bridgeford Rural Telephone Company have awarded the contract for the construction of their system to Somerville & Olson, c/o Frank E. Mann, Bridgeford. Material will be purchased by Geddie, McKay Ltd., 103 Darke Block, Regina. Approximate cost, $5,800.

Exeter, Ont.
The general contract for the erection of a hydro station has been let by the Town Council to B. Bawden, Exeter. Red pressed brick construction. Estimated cost, $5,000.

Montreal North, Que.
The Town Council have awarded the contract for the erection of a Town Hall to J. A. Charette, 142 St. Ferdinand Street, Montreal. Estimated cost, $27,997.

Montreal, Que.
Fire has caused extensive damage to the office building owned by the Read Building Company, Alexander Street. Loss, $75,000.

Work has been started by S. D. Valliers, 1431 St. Hubert Street, on the erection of four flats on Northcliffe Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000.

Owen Roberts, 112 Addington Avenue, has commenced the erection of two flats, estimated to cost $10,000.

Work has been started on the erection of a warehouse for the H. B. Smith Estate, 266 Mullin's Street. The general contract has been let to A. Chenevert, 108 Delorimier Avenue. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $20,000.

The Patterson Manufacturing Company, Ltd., 2021 St. Hubert Street, have commenced the erection of an office and warehouse building, estimated to cost $20,000. Work by day labor. Brick construction, concrete foundation, felt and gravel roofing.

Quebec, Que.
The Sharpe Construction Company, Fleurie Street, have started work on the erection of a theatre on Fabrique Street for the Imperial Theatre Company. Approximate cost, $10,000.

Work has been started by Lavoie & Frere, 56 Jeanne d'Arc Street, on the erection of a residence on Cartier Ave. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $7,000.

Louis Careau, 127 Scott Street, has commenced the erection of a residence on Lockwell Street, estimated to cost $6,000. Brick construction, concrete foundation, metal and asbestos roofing.

Toronto, Ont.
The Board of Control will receive tenders until November 23rd for the construction and erection of smoke breeching at the Main Pumping Station. Plans and specifications at office of the Works Department, Room 12, City Hall.

Fires

Belleville, N. S.
Fire has entirely destroyed the residence of Frank Melanson.

Christina Lake, B. C.
Fire has destroyed the hotel owned by O. Johnson. Loss, $8,000, insurance, $4,500.

Dungannon, Ont.
The barn and residence of Walter Maxwell have been totally destroyed by fire.

Gagetown, N. B.
Fire has completely destroyed the barns owned by George McDermott. Loss is partly covered by yinsurance.

Hillsboro, N. B.
Fire has entirely destroyed the barn owned by Thomas A. Steeves.

Lewisville, N. B.
Fire has totally destroyed the store owned by J. C. Cummings. Loss, about $2,000.

London, Ont.
The store at 127 King Street, owned by Arthur H. Keene, 458 St. James St., has been damaged by fire. Loss is covered by insurance.

Longueuil, Que.
The residence and outbuildings owned by Thomas Busby, Labonte Street, have been destroyed by fire.

Markinch, Sask.
Fire has entirely destroyed the elevator belonging to the Maple Leaf Milling Company, Ltd., 723 Grain Exchange Building, Winnipeg.

Penetanguishene, Ont.
Fire has totally destroyed the residence of Henry Zoschke.

struction, concrete foundation, felt and gravel roofing.

H. W. Creed, 686 Roslyn Avenue, has commenced the erection of a residence on Marlowe Street, estimated to cost $6,000. Brick construction, concrete foundation, felt and gravel roofing. Work by day labor.

Orillia, Ont.
George H. Adair has decided to rebuild his residence which was recently destroyed by fire.

Ottawa, Ont.
J. Villeneuve, 164 Bayswater Avenue, will start work shortly on the erection of a residence on Hinton Avenue, and will let some of the smaller trades. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

J. C. Thoms, 125½ Bank Street, is about to erect a residence on Simcoe Street, at an approximate cost of $3,800. Brick veneer construction, stone foundation, shingle roofing.

Work has been started by W. H. Lee, Billings Bridge, Ottawa, on the erection of a residence on Ossington Street, estimated to cost $4,500. Some of the smaller trades will be let. Stucco and brick veneer construction, stone foundation, shingle roofing.

Murphy & Morrow, Billings Bridge, Ottawa, contemplate the erection of a residence on Melrose Street, and have prepared plans. Roughcast and brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

Thomas Holman, 2 Oxford Street, is considering the erection of a residence on Hinton Street, at an approximate cost of $3,000. Brick veneer construction, concrete foundation, shingle roofing.

Quebec, Que.
Work has been started by A. Grenier, 294 Richelieu Street, on the erection of a residence on Lockwell Street. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $6,000.

W. Brochu, 87 Claire Fontaine Street, has commenced the erection of a residence on Aberdeen Street, estimated to cost $7,000. Brick and frame construction, concrete foundation, felt and gravel roofing.

Work has been started by J. A. Villeneuve, 282 St. Valier Street, on the erection of a residence on First Avenue, Limoilou. Brick and frame construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,000.

St. Marys, Ont.
Work has been started by George Ainslee, Dickie Road, on the erection of a residence, estimated to cost $3,200. Concrete block construction, concrete foundation, shingle roofing.

Sutton, Que.
A residence is being built for E. F. Carre, Manager of Molson's Bank. Work is being done under supervision of Charles Proctor.

Thorold, Ont.
Crompton & Crompton, Front Street, have commenced the erection of four workmen's houses.

Toronto, Ont.
R. Lucas, 48 Felstead Avenue, has commenced the erection of a pair of residences, estimated to cost $4,000. Smaller trades will be let. Brick construction, shingle, felt and gravel roofing.

Cox & Cummings, Confederation Life Building, have started work on a residence at McLean Street and Pine Crescent. Brick construction, shingle roofing. Approximate cost, $4,500. Smaller trades will be let.

Plans have been prepared for a pair of residences to be built at Queen Street and Neville Park Boulevard for C. P. Munro, 15 Toronto Street. Brick construction, shingle, felt and gravel roofing. Estimated cost, $4,000.

Work has been started by E. Gagnon, 2359 Queen Street E., on the erection of a residence on Glenmanor Drive. Brick construction, shingle, felt and gravel roofing. Approximate cost, $4,000. Smaller trades will be let.

Nightscales & Smith, 79 Woodbine Avenue, have commenced the erection of a residence at 85 Neville Park Boulevard. Brick construction, concrete and brick foundation, shingle roofing. Estimated cost, $3,000.

C. P. Munro, 15 Toronto Street, is receiving tenders for the brick work required in the erection of a pair of residences at Queen Street and Neville Park Boulevard. Approximate cost, $4,000.

Work has been started by J. Thorn, 221 Woodbine Avenue, on the erection of three residences on Ashdale Avenue. Brick construction, shingle, felt and gravel roofing. Approximate cost, $6,000.

CONTRACTS AWARDED

Chatham, Ont.
Work is progressing on the erection of a residence on Harvey Street for Celestine Blonde, 178 Joseph Street. The contract for cement and brick work has been let to Isaac Moore, the carpentry to Henry Blonde, 30 Cornhill Street, the painting to A. M. Burtch, 113 Raleigh Street, and plumbing to Mitchell Bros., 56 Fourth Street.

Galt, Ont.
In connection with the residence built on Salisbury Avenue for W. Chamberlain, 34 Lansdowne Avenue, the contract for slate roofing has been awarded to the Brown-Jarvis Roofing Company, 9 George Street, Brantford.

Hamilton, Ont.
The contract for masonry in connection with the residence being built for R. Kirkpatrick, 153 Herkimer Street, has been awarded to A. Beddie, 207 Burris Street, and the carpentry to W. Jamieson, 70 Harvey Street. Brick construction, stone foundation. Approximate cost, $5,000.

The general and masonry contracts for the erection of a residence on Markland Street for E. D. Sifton, City Hall, have been awarded to William Yale, 24 Leeming Street, the carpentry and roofing to Stuart Bros., 1 Hyde Park Avenue, the plastering to Hill Bros., 307 Emerald St. N., and painting to Smith & Omand, 177 Walnut Street. Estimated cost, $7,000.

The general and masonry contracts for the erection of a residence at Eastborne and Delaware Streets for W. E. Blanford, 524 Main Street E., have been let to W. Finden, 291 Catharine Street N., the carpentry and roofing to George Preston, 201 Stanley Avenue, and the painting to Boyd & Son, 607 Main Street E. Approximate cost, $7,000.

Montreal, Que.
Jean Brunette, 111 Grand Boulevard, has commenced the erection of flats estimated to cost $32,000. Brick construction, concrete foundation, felt and gravel roofing.

S. Dagenais, 2326 Boyer Street, is building three flats estimated to cost $5,000. The carpentry contract has been let to A. J. Jobin, 3335 St. Hubert Street, and the plumbing to J. O. Tardif, 937 Francois Barry Street. Brick construction, concrete foundation, felt and gravel roofing.

Ottawa, Ont.
Work is progressing on the erection of a residence on Murray Street for A. Levinson, 96 Blackburn Avenue. The general contract has been awarded to J. Mayre, 81 St. Patrick Street, the plastering to E. Bopry, 13 Henry Street, and heating and plumbing to J. T. Blyth, Frank Street.

The contract for heating and plumbing at the residence which has been erected on Renfrew Street for S. Rettie has been let to J. P. Booth, 382 King Edward Avenue.

The general contract for the erection of a residence on Concord Street for John Lister has been awarded to W. J. O'Connor, 495 Somerset Street. Double brick veneer construction, stone foundation, felt and gravel roofing. Approximate cost, $3,800.

In connection with the residence built on Sherbrook Street by J. W. Foster, 11 Irving Avenue, the contract for heating has been let to J. Cameron, 488 Lewis Street, and the electrical work to G. Matthews, 700 Albert Street.

The contract for electrical work at the residence being built on Sunnyside St. by B. A. Grison, 115 Fentiman Avenue, has been awarded to E. T. Headley, 645 Echo Drive.

Paradise, N. S.
The general contract for the erection of a residence for Rev. W. I. Morse has been awarded to J. F. Bent, Middleton, N. S. Concrete foundation, cedar clapboard, tile roofing. Estimated cost, $8,000. Previous report incorrect.

Quebec, Que.
A. Cloutier, 178 Queen Street, is building a residence on Charlesbourg Road for A. Drouin, 216 St. Francois Street. Brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $3,500.

Sarnia, Ont.
S. Scarlatta, 165 Lochiel Street, has let the general contract for the erection of two residences to W. D. Shaw, 139 William Street. Work has been started. Red brick, felt and gravel roofing. Approximate cost, $8,000.

George Andrew, Maria Street, has commenced the erection of a residence on Emma Street, estimated to cost $3,000. The contract for painting has been let to W. A. Jones, Cameron Street, and for heating and plumbing to J. Foreman, Mitton Street. Frame construction, concrete foundation, shingle roofing.

Work has been started on the erection of a residence on Wellington Street for

Miss B. McGibbon, 128 Queen Street. The general, masonry and carpentry contracts have been let to James Shanks, 227 Wellington Street. Estimated cost. $4,000.

Summerlea, Que.
Work has been started on the erec-Trust Company, Ltd., 180 St. James St. tion of three residences for the Marcil The general contract has been let to B. Desmarchais, Dorval, Que. Approximate cost, $9,000.

Toronto, Ont.
Contracts for the installation of sanitary conveniences in a number of houses have been let by the Board of Control to W. C. Schultz, 780 Crawford Street, Blackburn & Hiscock, 617 Crawford St., F. R. Maxwell & Company, 313 Queen Street W., and A. E. Melhinsh, 1174 College Street.

Windsor, Ont.
The general contract for the erection of a residence on Dougal Street for Mrs. J. Dowd, Wyandotte Street W., has been let to Thomas Robins, McKay Avenue, and the heating to the Windsor Hardware Company, 71 Sandwich Street E. Brick construction, concrete foundation, shingle roofing. Estimated cost, $3,800.

Work has been started by Ferguson & Thomas, 156 Hall Avenue, on the erection of two residences on Moy Ave. for John Ferguson. Brick construction, concrete foundation, shingle roofing. Estimated cost, $4,00.

Power Plants, Electricity and Telephones

Bay of Islands, Nfld.
J. Salters & Sons, Commercial Street, North Sydney, C. B., have made application for permission to develop water powers near this place.

Grand'Mere, Que.
Tenders are being received for the supply of one 500 h.p. turbine and corresponding dynamo for the Town Council. Particulars from the Engineer, L. S. Pariseau, New Birks Building, Montreal.

Guelph, Ont.
The Fire and Light Committee of the City Council are considering the installation of a box system of fire alarms. Work may be done gradually. Clerk, T. J. Moore.

London, Ont.
The City Council have decided to make additions to the lighting system on Richmond and Dundas Streets, at an approximate cost of $10,000. Work will be done by day labor. The installation of an ornamental lighting system on Market Square is also being considered. Clerk, S. Baker.

Newcastle, N. B.
The New Brunswick Telephone Company, Ltd., 22 Prince William Street, St. John, intend to construct two new circuits between Bathurst and Newcastle. The work will involve the use of about 35,000 pounds of copper wire.

Niagara Falls, Ont.
A by-law has been carried providing for the issue of debentures to the amount of $14,000 for the purchase of machinery and equipment for the Town electric station. Clerk, W. J. Seymour.

Sarnia, Ont.
The City Council have decided to submit a by-law at the January Elections providing for the installation of a hydro electric system. Clerk, James D. Stewart.

Sudbury, Ont.
The Town Councils of Sudbury and Copper Cliff are considering the lighting of the road between the two places, a distance of fourteen miles. Work may be done this fall. Town Clerks, W. J. Ross, Sudbury, and Thomas Stoddart, Copper Cliff.

Toronto, Ont.
The Toronto Hydro Electric Commissioners, 226 Yonge Street, are receiving tenders for overhead line construction work. Plans and specifications at office of the Purchasing Agent or the Engineering Department, 15 Wilton Avenue.

CONTRACTS AWARDED

Balgonie, Sask.
The Balgonie Rural Telephone Company have let the contract for the construction of their system to Joseph Burnett, c/o C. C. Rigby, Secretary to the Company. Approximate cost, $9,500.

Togo, Sask.
The Togo Rural Telephone Company have let the contract for the construction of their system to H. Tallman Company, Ltd., 111 Willoughby Duncan Block, Regina. Approximate cost, $10,000.

Wallaceburg, Ont.
The Town Council have let the contract for the construction of a four-mile transmission line to the Hydro Electric System, Wallaceburg. Estimated cost, $3,000.

Miscellaneous

Brantford, Ont.
P. H. Secord & Sons, Ltd., 123 Nelson Street, are in the market for a quantity of white brick.

Granton, Ont.
John Forrest is considering the purchase of equipment for a garage and repair shop.

London, Ont.
The City Council contemplate the purchase of a combination auto tractor and hose wagon, estimated to cost $12,000. Clerk, S. Baker.

The purchase of complete restaurant equipment is being considered by Wong Lem, 434 Richmond Street.

Matsqui, B. C.
The Municipal Council contemplate the purchase of a two-horse road grader. Clerk, J. Gibson.

Norwich, Ont.
Hoffman & Nethercott are considering the purchase of general equipment for a modern garage and auto repair shop.

Thamesville, Ont.
James Patrick is in the market for machine shop equipment.

Toronto, Ont.
The Monteith Pulp & Timber Company, Ltd., 123 Bay Street, are in the market for one medium-sized sawmill burner.

Tenders will be received until November 15th by Assessment Commissioner J. C. Foreman for the removal of houses at Nos. 28 and 30 Glen Road.

West Lorne, Ont.
The West Lorne Motors, Ltd., propose to manufacture gasoline tractors, and will probably purchase new machinery for this purpose in the near future.

CONTRACTS AWARDED

Windsor, Ont.
The City Council have awarded the contract for the installation of one 200 h.p. Scotch boiler to the International Engineering Works, Ltd., Traders Bank Building, Toronto. Approximate cost, $4,000.

Crushed Stone

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The Contract Record

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ESTABLISHED 1886

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Get Details Before Signing Contract

THE difficulty of obtaining full detailed information of what is really wanted when bidding upon work is one of the serious problems which confront the contractor to-day, for it is largely detail which determines what work is really worth.

Ordinary small scale drawings and specifications certainly do not sufficiently disclose what may be insisted upon, in detail, after a bidder has signed a contract. Some owners imagine they do, and that they tell a bidder all that is necessary. Others are indifferent; it is up to the contractors, they think. Others may secretly hope that some things may slip through without being noticed; this is the particular type of owner who is ever ready to profit by a bidder's error.

Of late years, however, there has arisen among contractors a strong desire to know more of what is required before a contract is signed, rather than be obliged to await the details afterwards. In common fairness there should be some way of disclosing the details beforehand, or at least as far as possible, so that all bidders receive reliable and identical data to figure upon. Not only that, but if for any reason the character of any of the details should be simplified, after a contract is let, it would be more likely to serve as a check against any possible unfairness.

Fortunately for the building industry, there are many architects who give, as well as expect, a square deal. These are well known by bidders and they are respected as men and as members of an honorable profession. But it seems to be generally understood that there are "others," and it is from the offices of the latter that contractors obtain a more accurate idea of what is wanted after the contract is signed than before. Then it is too late. Many a contractor has been caused financial difficulty because of the business viewpoint (?) such architects display—not provided for, of course, by any clause in the contract. The better type of contractors avoid the offices of such architects, or, when invited to figure, they discreetly raise their bids high enough to cover possible contingencies.

The point under consideration is whether details should be furnished before or after a contract is let? It is a question raised by Mr. G. Alexander Wright, of San Francisco, in correspondence with this journal. Mr. Wright is a prominent U. S. advocate of the Quantity System.

It is obvious that there can be only one answer to this question. If details are not ready when the job is being figured they should certainly be in the hands of the contractor before he is called upon to sign up. It would surely be a more equitable way of letting a contract. Now as details must be prepared and furnished at some time, is there any logical reason why this should not be done at a time when such information would be of the greatest value to the bidder, i.e., when he is making up his prices? Why keep back vital information? It is not to the bidder's advantage, of course. Who is it that benefits? Is it the owner? Or is it for the greater convenience of the architect? Whatever the reason, can it be regarded as fair to the bidder? It is obvious that an individual bidder is helpless. He cannot force the issue himself. But collectively through their organizations, contractors might make reasonable and proper representations of these facts to their local architects with a view to the betterment of the conditions named.

Certain remedies have been suggested from time to time. One is the quantity system. Some remedy is necessary. One that would seem to afford relief without causing hardship to anyone, would be the passage of city ordinances providing that applications for building permits, for work above a certain estimated cost, should be accompanied not only by the usual plans and specifications, but by details to a scale of, say, not less than 1½ in. to the foot, or sufficient to indicate the character of the work which is to be performed in detail.

It takes no longer to study the details of a structure before a contract is entered into, than afterwards. It has to be done at some time. The owner who is so often unduly impatient to see his building started, would soon learn to adapt himself to the new condition, if he realized that his architect was simply conforming to the law. There would be just as many buildings erected, and bidders would understand more clearly what it was they were bidding upon.

Report on Pollution of Boundary Waters—An Important Sanitary Work

THE year 1909 commenced a new era in the relations between this country and the U.S.A. for it was on that date that a treaty was signed at Washington for the purpose of preventing disputes regarding boundary waters and to settle all questions involving interests in the common frontier. Under this treaty certain clauses relating to the maintenance of water levels and the pollution of international waters were referred to a joint commission which was given jurisdiction over these matters. This commission, composed of three members from the Dominion of Canada and three from the U.S.A., and known as the International Joint Commission, was also instructed to ascertain to what extent the boundary waters have been polluted and are injurious to health and property, and to suggest remedial measures. Although the Commission has now been in operation for several years it is a regrettable fact that, considering the enormous sanitary and economic interests involved, their work has not aroused greater interest in the engineering profession and the general public. The boundary waters over which the Commission has jurisdiction support a population of over seven million people and their health is intimately bound up with the condition of these waters. The economic interests are represented by the water power available for energy transmission and by navigation and irrigation. Official reports indicate that some 95,000,000 tons of freight, valued at over $800,000,000 and carried by 26,000 vessels pass through the Great Lakes systems annually whilst irrigation is a "sine qua non" for the development of the western provinces.

The investigation of the pollution of boundary waters as commenced several years ago and in addition to hearing local authorities the Commission appointed several experts to examine and report upon the existing conditions. After making thousands of examinations, the report was presented and finally considered by sanitary engineers who suggested remedies and regulations. The reports of the various experts engaged on this important sanitary work can be obtained on application to the Secretary of the Commission in Ottawa, and we would urge upon our readers to secure copies at once as these are limited in number.

"Good Roads" Men Fraternize

Two National Associations Exchange Road Facts and Fraternal Amenities

The largest and one of the most inspiring meetings of paving brick men in the history of the industry assembled at Dayton, Ohio, on October 11, 12 and 13. The presence of the American Society of Municipal Improvements at the same time and under the same roof was largely responsible for the unusual success of the occasion. Splendid opportunity was afforded the brick fraternity to impress their message of highway permanency upon the willing ears of municipal engineers from all parts of the continent.

The lesson was not wholly one of words. Dayton affords the example of some of the most admirable brick roads and streets to be found anywhere in America. Through the generosity of Dayton auto-owners and the enterprise of the Greater Dayton Association, opportunity was afforded all visitors to inspect these roads and to test their riding qualities. Wednesday afternoon was devoted to a tour by this motor cavalcade. Much of the mileage inspected lies on the line of the new National Pike, which is being paved across the entire width of Ohio. Dayton was not on the route of the original pike, having grown to its present importance since the days of pioneer road building. But when the renewal of this historic highway was undertaken, no question was raised as to the propriety of a slight divergence from the original route, so as to include this city.

Brick Pavements Withstood Dayton Flood

The tourists also passed over brick pavements which withstood the severity of the Dayton flood of two years ago, a test which ripped up, as by a plowshare, many other forms of pavement.

The association banquet took place on Tuesday evening. The brick men were hosts and the American Society of Municipal Improvements were guests at this affair. It was marked by a spirit of splendid fellowship and by the utmost perfection of detail in the art of entertainment. Four hundred and fifty members and guests were served. A unique touch of delicate advertising was imparted when the ice cream was served upon souvenir plates, into each of which a brick street of scenic attractiveness had been burned.

President Thompson of Ohio State University spoke on "Efficiency and Economy in Public Expenditure." He said that "Sentiment was less inclined than ever before to limit expenditures of public money and more prone to demand that value be rendered for every dollar expended. It is not probable that we will ever spend less than we are spending at the present time, the state and nation are growing so rapidly that increased expenditures must grow to keep pace with population. Standards of living are constantly rising and creating new demands which must be filled."

Tribute to Engineering Profession

The speaker paid a glowing tribute to the engineering profession. "It has been my fortune to be associated with all kinds of engineers and I have never known a class of men who were, as a rule, of higher integrity, in spite of the fact that, as human beings, they may sometimes be mistaken in their judgments.

"The public usually gets what it wants and good engineers have taught it to want men of high ability and devotion in all public offices. I predict that the

The American Society of Municipal Improvements inspecting the "Pave with Brick."

time is not far distant when the selfish man will be ousted from public life."

Montgomery county and Dayton have undertaken brick road projects to the extent of twenty-five miles in the past two years and ex-governor Cox devoted much of his time to a frank discussion of a paving policy. He declared without hesitation for the use of brick on the main market roads. He dwelt upon the wide distribution of good road benefits as an argument for the broadest co-operation in securing roads. One of the greatest sources of the impulse for improvement, he said, has been the centralization of rural schools. These schools are dependent upon good roads for their successful operation. He alluded to his experiment in the making of brick by convict labor and declared that he was convinced no advantage lies in having the state compete with private enterprise, where the latter is economically conducted.

The Justifiable Outlay on Highways?

By Clifford Richardson[*]

THE justifiable outlay in the construction of a road is a function of the travel which it is called upon to carry. This necessarily implies the adaptation of the form of construction to the load to be sustained, the frequency of it, and the speed with which it proceeds. There is no rule that can be applied to such a situation. Each case must be considered and decided upon its merits.

The justifiable outlay should be one that will give an adequate return, under the service to which the surface is to be subjected. It should be one that service tests have demonstrated will, with proper maintenance, accomplish an economical result.

The justifiable outlay must not be looked upon from the point of view of first cost alone, but of first cost plus maintenance during the life of the surface, the cost of the surface and not that of the entire road upon which it is to be placed. Money expended in original construction of a permanent nature, such as drainage and foundations, must be regarded as a lasting investment, if properly done, which is too often not the case, and differentiated from that of the surface which must be renewed from time to time.

The general answer to the question which is to be considered is: Pay enough to obtain a road which experience has shown will serve under the conditions which it is called upon to meet. Such a form of construction for heavy travel cannot be obtained with inferior materials or for a low price. Service tests of roads subjected to similar conditions are the best criterion for guidance. They are the only means of determining the value of any form of construction. Time is, necessarily, an element in obtaining data of this description. Tried-out forms of construction, and materials of construction used therein, are, therefore, the best evidence of how a road should be built in the future. Unfortunately, too often the proper lesson is not learned from such experience.

A justifiable outlay may be said, therefore, to be a sum which, when skillfully and honestly applied, will accomplish a result which is satisfactory from the point of view of economy and utility. It must be regulated by the traffic, and the expected traffic, which the road will be called upon to carry.

Study the Conditions

Individual cases should, of course, be treated in different ways. A main artery requires a type of surface corresponding to a city pavement, and such a form of construction will be essentially the most economical in the future. Any road surface affords very little service unless it is supported on a proper foundation, and eventually it will be more economical to construct this of Portland cement concrete than to temporize with the matter. Such a foundation may be looked upon as an investment which will give a return for a long period of years.

The secret of successful road construction, to meet heavy travel, lies in proper design, proper construction or execution of the design, and the use of tried-out materials, but, more than this, the economy of any method of construction is dependent largely on the manner in which it is maintained.

Little that is new can be said on the subject of bituminous highway construction, except to apply the conclusions derived from actual service tests, which are now, in some instances, about seven years old as relating to modern types, but a realization of the important points can only be accomplished by reiteration. Improper principles of construction are often inherited from the customs of previous years, and there is great difficulty in getting away from old and long established prejudices and specifications, and the desire to build the largest mileage for the least money. This is well illustrated, as exampled by experience in the paving of our city streets with wood and asphalt blocks. Although it has been demonstrated in England for years that a wood block should be placed directly on a smooth concrete surface and cemented thereto with coal-tar so as to prevent the entrance of water at the bottom of the block, the method of construction in use in this country which permits of the infiltration of water, is still employed. The same can be said of our asphalt block pavements which are so laid that there is no bond between thesurface and the foundation, the result being that the blocks are badly displaced under our modern motor travel.

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[*] Consulting Engineer, New York, N.Y.

Profit by Others' Experiences

Work which has been demonstrated by service tests to be satisfactory should be imitated if the best results are desired. Years ago, when the writer took up the construction of sheet asphalt pavements, the lines of procedure were based upon the study of those surfaces in various localities which had proved the most satisfactory.

The evidence derived from this study offered a basis for our modern ideas of how work of this type should be successfully done, and there is no reason why similar principles should not be applied to road construction. We should study those road surfaces which have given the most satisfactory results and the most adequate return for the money expended upon them and imitate the principles employed in their construction in future work. The most valuable inference can thus be drawn from past experience.

The greatest enemy of good road construction is the desire to get something at a price inadequate to meet the conditions imposed. Any expenditure is justifiable which is necessary to meet such conditions and give satisfaction. It is an economy in the end.

It has been stated by the Massachusetts Highway Commission that the cost of maintenance on the heavier travelled roads in that state has reached $1,000 per mile per annum. If the life of a road surface is assumed to be ten years it is evident that half of the sum necessary for maintenance during this period, if expended in the original construction, would be a true economy and one which would yield an adequate return. There is ample evidence that an additional expenditure of 10 to 20 cts. per sq. yd. for the original cost of construction of a road with the best material, will generally be found to give more than an adequate return in the reduction of the cost of maintenance during the period of the life of the road.

Don't Spoil by Stinting the Cost

The greatest enemy of good road construction lies, without doubt, in original economies. The satisfactory nature of any form of road construction is not to be determined by its original cost, but is only demonstrated by the travel which it has carried during the period of its existence and the amount of service obtained from it.

In considering the economies of road construction to sustain heavy travel, the following points should be given careful attention:

(a) Permanent features of construction:
  1. Subsoil foundations.
  2. Drainage.
  3. Adequate foundations for the surface.
  4. Adequate lateral support.
  5. Properly proportioned thickness for the several courses.

(b) Surface construction:
  1. The use of materials and form of construction demonstrated, by previous experience and service tests, to be satisfactory, and to give an adequate return for the money expended.

Experience has shown that danger in road construction lies in:

1. False economies in original design.
2. Bad or inferior workmanship.
3. Awarding the contract universally to the lowest bidder.
4. Unsatisfactory execution of the work due to lack of intelligent control on the part of supervising engineers.
5. Neglect of careful study of individual problems of construction and of successful work under similar conditions.
6. The influence of mercenary and political motives.
7. **Neglect of proper maintenance.**

In conclusion it may be said that the justifiable outlay for road construction should be based on the results to be expected as demonstrated by previous service tests of various forms of construction. It is a question of economies as well as of engineering, a question of how to get an adequate return for the money expended. This will not be attained by any of the cheaper forms of road construction in most cases. The passion for economy, which is so universal to-day, owing to the desire to build a large mileage of road with the money available, is plainly being overdone.

Thousands of dollars are now thrown away on forms of road construction which can give no adequate return for the expenditure.

Architectural Features in Design

Engineers in this country should exert more influence in the development of architecturally pleasing effects in the design of structures than they have done in the past. Frequently the pressure brought to bear upon them by owners or officials of corporations and municipalities who control the design of engineering construction and insist upon mere utility and, sometimes, upon lowest first cost, is hard to resist. It is encouraging to note cases in which this pressure has been successfully resisted and overcome. Engineering work should not be wholly utilitarian. In all cases where natural surroundings require it, where the consistent development of a great architectural plan is possible, or where the presence of appreciative observers is probable, the element of general architectural appearance should be given consideration. We are still far behind European engineers in this respect. Surely the great natural wealth of this country can be better applied in this direction than we have yet succeeded in applying it.—Engineering Record.

Toronto High School of Commerce

To be completed by the spring of 1916

The new High School of Commerce with its typically collegiate style of architecture, situated between Shaw and Roxton Streets, north of College, marks the culmination of a comparatively new idea.

In historically recalling a few facts about the division between the Technical and Commercial subjects of the curriculum of the Board of Education, it will be remembered that some few years ago the attendance at the Technical School on College Street (now in the hands of the Military Authorities) under the able hand of Dr. MacKay, grew to such proportions as to cause the building to be inadequate in its accommodation, which when compared with the new Technical School and the building which forms the subject of this article was only primitive. Thus it was deemed necessary by the Trustees to classify into two distinct groups, viz.: The Technical Subjects and the Commercial Subjects with Dr. MacKay and Principal Eldon as their respective heads, the latter having temporary quarters of eight rooms on the top floor of King Edward School, later being transferred to Clinton Street School.

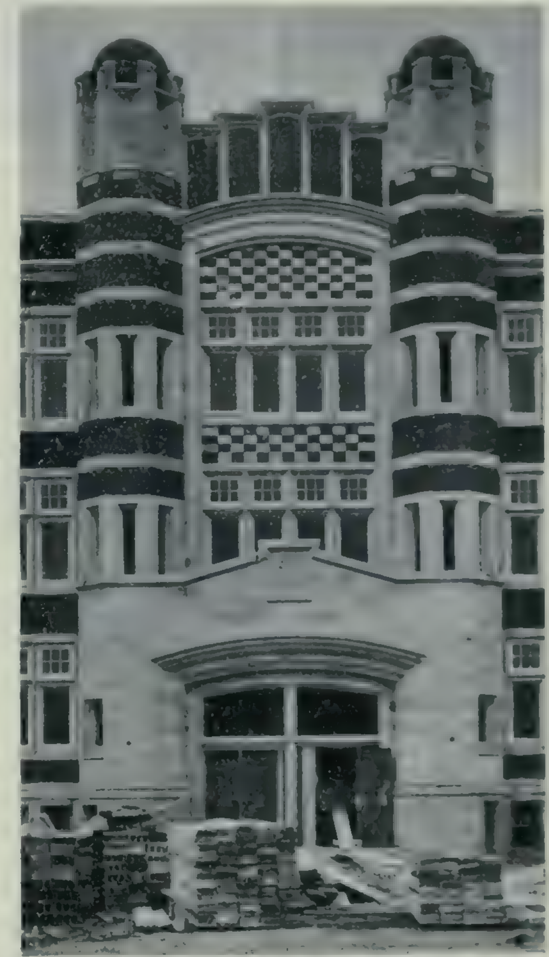
The site of the new building which was formerly a ravine with small cottage property on its boundaries has materially improved this part of the city in eradicating what had of recent years become a dumping ground, and it is intended next year to arrange the foreground into the form of a park with tennis courts, etc.

The exterior has been executed with John Price dark red facing brick laid with Flemish Bond, the design being completed with well detailed dressings of buff Bedford Indiana limestone. As in many other collegiate buildings throughout the universe, the Tudor period of Gothic architecture has been chosen.

Entering the building through the portals of the south entrance, one is attracted by the spacious rotunda with its stately columns, which are of steel encased with Gothic panelling, moulded caps and bases of quarter cut white oak, springing from a floor finished in terrazzo and marble. Leading to the upper floors are two main grand staircases of steel plate construction and wrought iron ornamental design with two east and west and two north auxiliary stairs of similar construction which, combined with corridors of reinforced concrete slab construction and walls and partitions of solid brickwork, constitute what may properly be termed a semi-fireproof construction building. The corridors forming direct lines of circulation are well lighted and of good width, and give perfect access to the various rooms and assembly hall (80 ft. 0 in. x 60 ft. 0 in.).

Perhaps an explanation in regard to the assembly hall and its great contrast in design to that of the main building will be of interest. This hall is not intended wholly for the use of the students, but also for the hire of the ratepayers generally for various purposes such as drama, concerts, public meetings, etc. With this idea in view, a freely treated design of ornate staff plaster enrichment embodying a strong feeling of the Art Nouveau has been selected to meet the cosmopolitan taste of the people. Nevertheless, it provides the city with one of the most suitable and convenient halls, and will, it is believed, meet the desires of all classes.

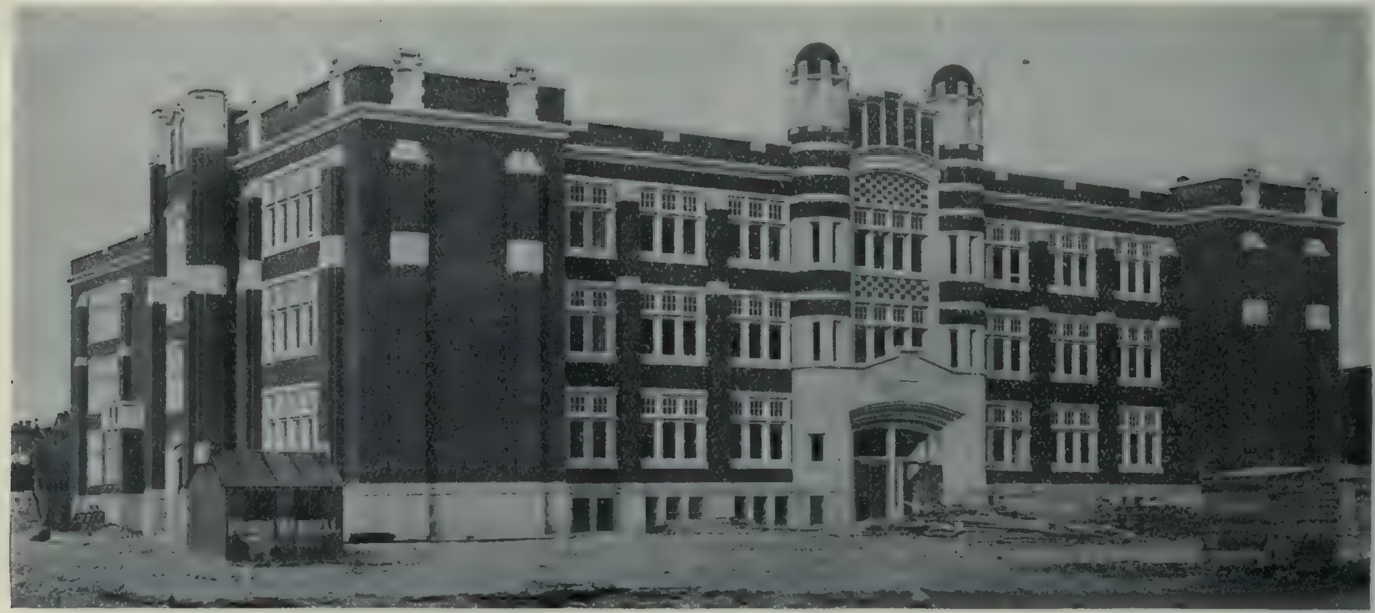
The balcony and floor are of reinforced concrete construction with the main structural members including those forming the roof and trusses of steel. The total seating capacity is 972 exclusive of the large stage, leading from which are the essential dressing rooms. Expansive ceiling and sky lights form the nucleus of the natural lighting, and with exhaust fans and rotary ventilators will greatly assist in the ventilation. Perfect acoustic properties have been obtained as the result of careful consideration.



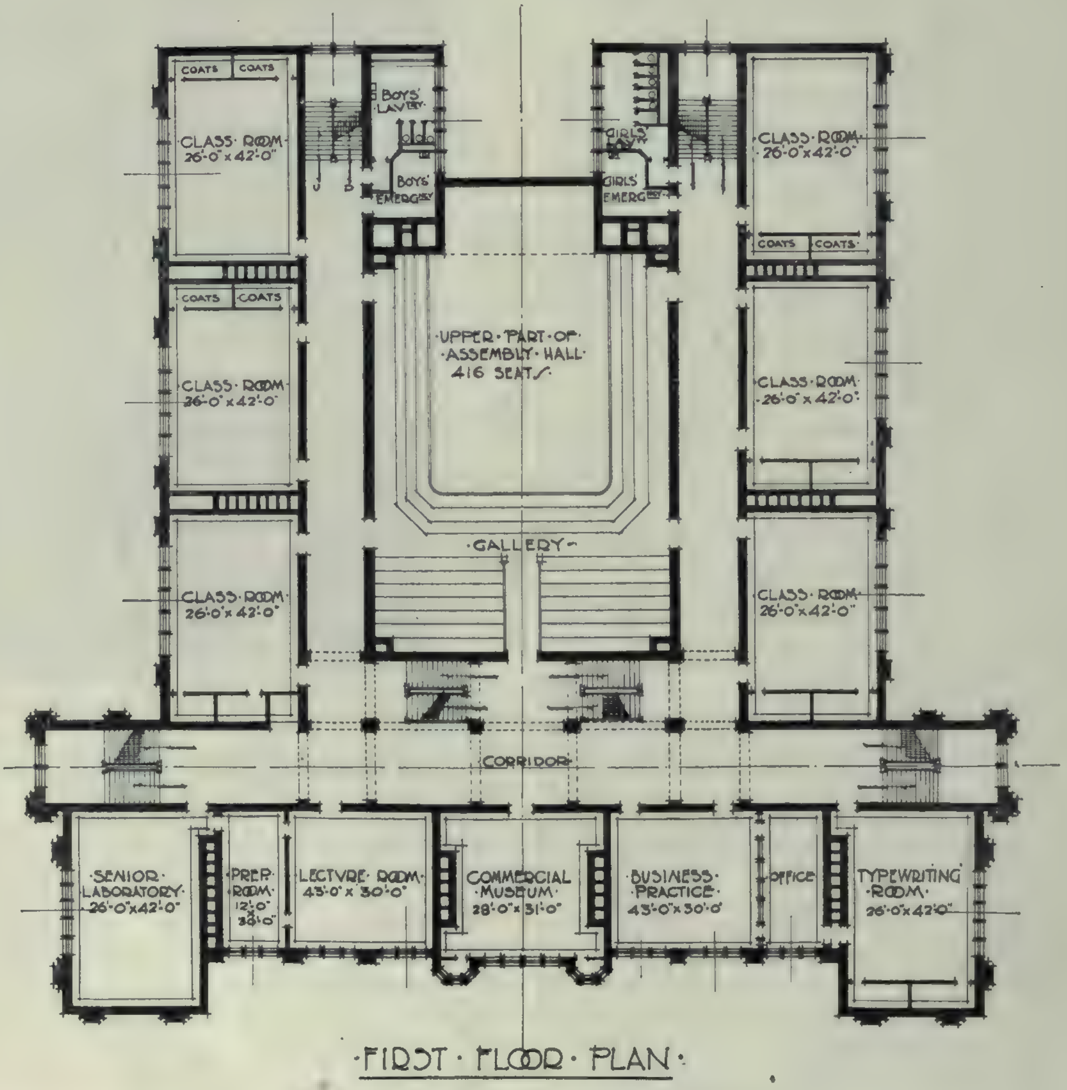
Main Entrance—High School of Commerce, Toronto.

In addition to twenty-one class rooms, there are two lecture rooms, two typewriting rooms, two laboratories, (senior and junior) business practice room, commercial room, art room and library, complete with administration offices. Most efficient natural lighting for these rooms is obtained by large cluster windows with sliding casements, artificial electric lighting being given by the indirect system. Each room is connected by local telephones to the administration offices, with provision made for the future installation of an elevator from the basement to the top floor.

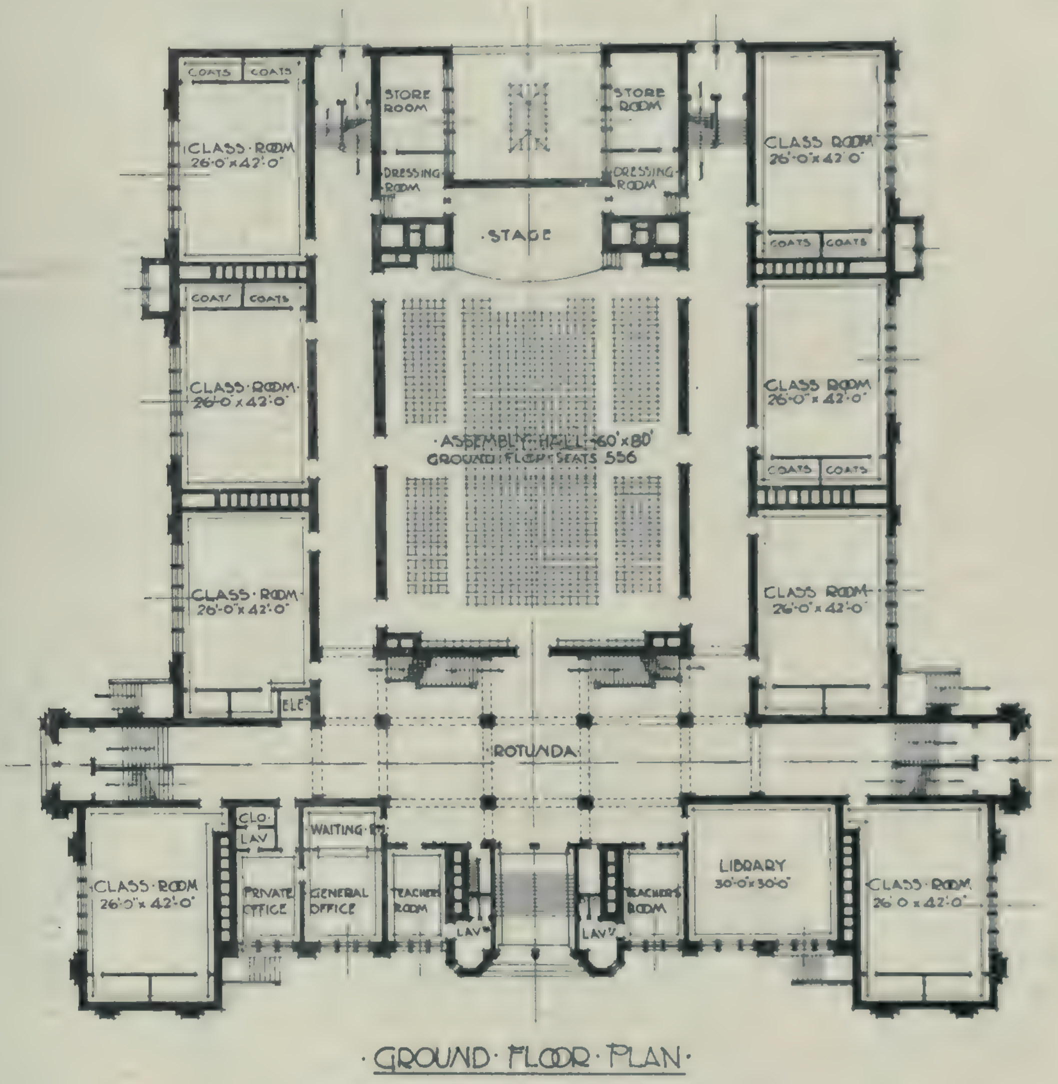
The finish of all class room floors is in white maple with sound deadening felt under, which fulfills all that



Exterior view of Toronto's handsome new School of Commerce.


COATS
COATS
CLASS ROOM 26'-0" x 42'-0"
BOYS' LAVTRY
BOYS' EMERGCY
GIRLS' LAVTRY
GIRLS' EMERGCY
CLASS ROOM 26'-0" x 42'-0"
UPPER PART OF ASSEMBLY HALL 416 SEATS
CLASS ROOM 26'-0" x 42'-0"
CLASS ROOM 26'-0" x 42'-0"
GALLERY
CLASS ROOM 26'-0" x 42'-0"
CLASS ROOM 26'-0" x 42'-0"
CORRIDOR
SENIOR LABORATORY 26'-0" x 42'-0"
PREP ROOM 12'-0" x 30'-0"
LECTURE ROOM 43'-0" x 30'-0"
COMMERCIAL MUSEUM 28'-0" x 31'-0"
BUSINESS PRACTICE 43'-0" x 30'-0"
OFFICE
TYPEWRITING ROOM 26'-0" x 42'-0"
FIRST FLOOR PLAN

First Floor Plan—High School of Commerce, Toronto.



Ground Floor Plan—High School of Commerce, Toronto.

may be desired for warmth and cleanliness. Two dadoes are treated with painted burlap with general trim of Georgia pine of oiled finish.

The basement gives one the idea of a first class cafeteria, there being a large luncheon room for the noon-day meal accommodation with kitchen and pantry service complete with a dining room for teachers. The remaining portion is chiefly occupied with large and well ventilated recreation rooms. Few of our public buildings have as good toilet facilities as are seen in the basement and other parts of the building; they are an example of hygienic construction and cleanliness with their tiled floors and walls and white Canadian marble partitions and sanitary ware of the latest improved type.

The heating and ventilating are of the vacuum system under the scheme of the C. A. Dunham Co. Ltd., with direct and indirect radiation. The vitiated air is removed from the rooms and corridors by means of exhaust fans, and their capacity, with that of the ducts, provide to all rooms simultaneously 1,500 cubic feet per minute with a complete change of air once every ten minutes.

The total cost of the building which will be ready for occupancy by the forthcoming spring is $277,273, the first contract being signed September 1914.

Finally, it may be pointed out that rapid progress has been made in the execution of the various works in spite of the outer shell of the building having been erected during the winter of 1914-1915. It is the largest school constructed under the supervision of Mr. C. H. Bishop, Superintendent of Buildings.

The following firms carried out the work of their respective contracts,—R. Robertson & Sons, Ltd., masonry; Nicholson, Curtis & Vic, cut stone; Dominion Bridge Co. Ltd., structural steel; Crocker & LeDrew, carpentry and interior finish; A. C. Richmond, reinforced concrete; Jas. A. Berridge, plastering; Bailey & Oben, staff plaster enrichment; Jas. Phinnemore, painting and glazing; Shipway Iron, Bell & Wire Manufacturing Co., ornamental iron and iron stairs; Missisquoi Lautz Corp'n. Ltd., terrazzo flooring and marble work; Purdy Mansell Co. Ltd., plumbing, heating and ventilating; Johnson Temperature Regulation Co. Ltd., heat regulation; Fred Armstrong Co. Ltd., electric wiring.

Sewage Treatment and Disposal

By R. O. Wynne-Roberts (continued from last week's issue)

Shovel-vane Screen—This name is a literal translation of that given it in Germany. The screen is composed of a number of curved vanes radiated between the hollow shaft and the perimeter. The shaft is hollow, open at the top and has within it a conveyor to remove the screenings as they are discharged from the vanes. There is a brush attached to an arm between each vane to sweep off any matter that adheres to the screen. The various parts of this screen are operated by an electric motor and each part is arranged to come into action at the proper time. The screens are built up of V section wires, at Gleinitz. They are 3 mm. apart and the removal amounted to about 63 per cent. of suspended matter.

Drum screens have the shape of a shallow dish set on end facing the stream. These screens are internally divided by radial plates into a number of compartments so that the screening can be raised up as the drum revolves and dropped into a hopper. Any materials clinging to the screen are blown inwards by an air jet. The screen at Trier is 14½ feet in diameter and 3.94 feet deep. The perforations are 1/10 in. in diameter and spaced so that the width of metal between the holes is only 0.04 in. A one horse-power motor rotates the screen once every three minutes. A two and a-half horse-power motor operates the air compressor and another a half horse-power motor swings the air nozzles and circulates water for the air compressor.

Cylinder Screens—The Weand screen as installed at Reading, Pa., Atlanta, Ga., Baltimore, Md., and Brooklyn, Mass., represents this class. These screens are cylindrical in shape, the sewage enters at one end through a fixed central opening leading to a tray, from which it is distributed sideways against the screen. The garbage retained by the screen is moved forward by spiral guides to the other end of the screen and there discharged. The Weand screen at Reading is covered with Monel metal, having 36 meshes per lineal inch and protected by a coarser screen. The garbage which clings to the screen is washed off by a series of water jets fixed at the external crown.

Disk Screen—This is represented by the Riensch-Wurl screen. It is somewhat like a flat rimmed hat in shape, set at an angle of about 20 deg. to the horizon and partly immersed in water. This screen is made up of perforated plates with slots from 0.04 to 0.20 in. wide attached to a frame hung from a shaft which is supported by beams. Such screens have been installed at Dresden in Germany and in several other cities. The Dresden screens are 26.2 ft. in diameter, have 0.08 by 1.20 in. slots, and a total area of about 600 sq. ft. The screens are rotated once every three minutes but this speed can be varied considerably. The screenings are brushed off into a channel and discharged. The screen-plates are of bronze, or brass, with bevelled perforations so that the material may be released freely. The efficiency of removal of suspended matter is reported to be from 60 to 70 per cent.

Having described the salient points of each type of screens, the question which naturally comes next is, what are the advantages and disadvantages of these various screens. Before these matters can be discussed it will be well to understand what is expected of screens and in this connection Mr. Kenneth Allen's conditions may be accepted, namely, that a fine screen (a) must remove a sufficient quantity of the suspended solids and total organic matter in regular operation to satisfy the needs of the situation. In other words, its efficiency must be adequate. (b) In operation it must be reliable and in capacity it must be ample, under the conditions of sewage flow and surface elevation which may obtain. (c) Its operation must be free from nuisance and unsanitary conditions. (d) All parts must be accessible for inspection, repair and renewal. (e) The cost of installation must be low. (f) The cost of operation, renewals, and repairs must be low.

In respect of the first condition Mr. Langdon Pearse, divisional engineer Sanitary District of Chicago, stated that the efficiency of screens depends on (1) the size and shape of the mesh or screen; (2) the loss of head under which screens are operated; (3) the character of the suspended matter; (4) the freshness of the sewage, which in one of domestic origin will be influenced by the area sewered, the time of concentration, and the condition of the sewers; (5) the dilution of the sewage, the gallons of flow per capita, or the concentration of suspended matter; (6) the type of screen.

Efficiency of Screens

The efficiency of screens is affected by the condition of the sewage. Mr. Rudolph Hering referred to a simple experiment made by Dr. Travis, namely, allowing fresh sewage of a house to pass through a paper filter, and allowing the filtrate to stand. This was rarely found to become putrescible. It is the solid and colloidal matter that decomposes and this action sets in quickly. This being the case, the sooner the solids are removed the better. It will be readily understood that where sewage has to travel a considerable distance "the solid matter is broken up, comminuted and dissolved." Further, the solids which are screenable have become friable and are easily acervated, so that in passing through a screen especially when there is a considerable difference in the water levels on the upstream and downstream sides, much solid matter is further broken up. Mr. O'Shaughnessy, Birmingham (Eng.) found that foecal matter forms a colloidal solution when agitated with water, and doubtless some screens tend to act in this manner. The cleaning of some screens again further tends to force solids through the mesh or plates. Rakes operating under water disturb the collection of solids and the hydrostatic head forces some through. Consequently it is necessary that all cleaning of screens should be done above water, which is new being done in all recent installations of moving screens. It is interesting to note to what extent screens of different meshes remove suspended matter. This is as investigated in Chicago by Messrs. Wisner and Pearse and they, according to Mr. Kenneth Allen, obtained the following results:—

With slot measuring 1.00 by 0.0625 in. the average reduction in suspended matter was 14 per cent. and the sewage was backed up 18 in. in 28¾ minutes, when passing sewage at the rate of 11,100 U. S. gallons per sq. ft. daily. Slots 0.50 by 0.032 in. removed 20 per cent. and the loss of head of 18 in. took place in 9 min. 8 sec., the volume of sewage being the same as above. Slots 0.050 by 0.025 in. removed 25 per cent. and under similar conditions caused the same loss of head in 7 min. 14 sec.

Screens having different mesh per lineal in. were also tried and the results were:—

6 meshes	13 per cent. removal
10 meshes	10 per cent. removal
16 meshes	17 per cent. removal
20 meshes	16 per cent. removal
24 meshes	21 per cent. removal
30 meshes	20 per cent. removal
40 meshes	26 per cent. removal
60 meshes	23 per cent. removal
80 meshes	33 per cent. removal
100 meshes	29 per cent. removal

Screens vs. Settling

Mr. Pearse mentions that a 30 mesh Weand type of screen was tried and the reduction in suspended matter was only 8 per cent. the improvement in the oxygen demand being only 6 per cent. whereas by settling the screened sewage the suspended matter was altogether reduced 66 per cent. and the improvement in oxygen demand was 42 per cent. As Mr. George A. Soper, president of the Metropolitan Sewerage Commission of New York stated, screens remove suspended matter according to size, and tanks according to weight of the particles, but neither according to composition. The New York report mentions the fact that screens remove much of the solid matter but the demand upon dissolved oxygen is not materially lessened. This is confirmed by Mr. Wisner of Chicago in his report and records prove the quantity of suspended matter left in the sewage after screening to be usually greater than that detained by the screens with the result that from the standard of biological oxygen demand the change is slight. Mr. G. W. Fuller expressed the opinion that screens are preferable to settling tanks only where it is desirable or necessary to remove only relatively large sewage matter in suspension. Where settling solids would form deposits in the water courses if screening alone were adopted, to install settling tanks will prove wiser than to install fine screens. In certain places it may be economical to install screens first to be followed later on by settling basins, as occasion demands. Settling tanks as a general rule are cheaper to install than screens, because for a given cost they will remove a greater quantity of organic matter. Mr. Hammond of Brooklyn claimed that two storey tanks with twenty minute retention were more efficient than screens. Kinchling again, maintained that fine screens with one millimetre openings were as effectual as tanks with 1½ retention. In many instances, where wing or drum screens are in use grit chambers are not provided as grit is caught by the screens. Where settling tanks are constructed the use of fine screens is deprecated as unjustifiable expenditures. With tanks the loss of head is small and does not vary. Tanks do not deteriorate or need renewals like screens; they require less skilful attention, but require more area. Grease adheres to screens and occasionally requires solvents or steam to remove. The cleaning of screens is a subject which is receiving considerable attention. Rakes, scrapers and brushes tend to push some of the organic matter through the screens, hence the use of compressed air to blow the screenings. Mr. Kinchling thought the use of vacuum would be desirable for cleaning screens and no doubt we shall soon see it applied.

Carsbolton screens are operated by under-shot waterwheels driven by the flow of sewage. Consequently the speed of travel of the screens is proportional to the volume of sewage. Where screens are operated by electric motors the rotation is not proportional and with increased flows of sewage the backwater tends to increase. Mr. Kinchling said that "this loss of head might be utilized to control the speed of the moving screen, in order to prevent excessive backwater, and the development of internal pressure in a closed conduit." As already pointed out, to receive the best results screens should be located as near the points of pollution as is possible and as under careful management there is but little smell or nuisance arising with fresh sewage, screens could be placed in built up districts, provided that the screenings are not kept there. It was found at Baltimore that screens located between the tanks and filters were advantageous, as the work of two men attending to cleaning fixed nozzles on six to nine acres of filters was reduced from eight hours to two hours per day. There are many points to which reference could be made but space and time is limited, so a few more items only will be touched upon. The possibility of by-passage of solids should be prevented. The screen should be simple in design, strong in construction, easy to renew and provision should be made to screen sewage when the screen is under repair. The area of openings should be ample so that the backwater may be kept as low as possible.

Floatage Chambers

Mr. Rudolph Hering suggests floatage chambers for New York in which the velocity of the sewage flow would be reduced and suspended matter lighter than water would rise to the surface and be skimmed off.

The sampling of sewage is a matter of importance because the efficiency of screens cannot be judged by casually sampling, for sewage changes in character and composition. Mr. Kershon who was the engineer to the Royal Commission on Sewage Disposal, pointed out that samples should be from corresponding sewage, one way to ensure this being the use of a coloring dye. Mr. Jennings of Chicago collected a series of samples in a large jar and mixed them.

Mr. George C. Whipple referred to an interesting means of recording samples of sewage or water by the use of absorbent cotton discs, which are also employed to ascertain the quantity and character of sediment in milk. These discs, supported by wire gauze, are placed in the neck of an empty milk bottle. Another bottle filled with the sample of water or sewage is inverted over the empty one and by forcing air into the former its contents are discharged into the latter, and at the same time the cotton wool disc retains the suspended matter. This straining method is simple, easy and quickly manipulated, and the discs form visual records, which may be mounted for future reference.

In conclusion a few quotations from the Philadelphia report will be culled:—

"In Germany the preparatory treatment of sewage has been developed to a very high degree not only in the tankage of sewage, but also in removing the suspended solids by means of screens. In many German cities the sewage is collected to central points, passed through grit chambers and screens having sufficiently small openings to remove practically all appreciable sized solids and disposed of by diffusion in the river water through submerged outfalls.

"Such treatment works are more compact than those using any other processes. No deep excavation for tanks is required and, where necessary, the screenings can be incinerated at the plant, thereby eliminating the need for sludge drying beds required for tank treatment.

"At Dresden, for instance, 26,500 000 gallons a day of sewage are passed through screens. The building required is 85 feet x 230 feet in plan, and the foundations are 12.5 feet below the water level in the sewer. A similar capacity treatment works consisting of Emscher tanks and sludge beds would occupy a space of 150 feet x 500 feet and 30 feet below the water level in the sewer.

The tank installation would remove a larger percentage of the suspended solids in the crude sewage than the fine screens, but there are circumstances where the oxidizing power of the river water can be utilized for the assimilation of the fine particles passing through the screens.

Mr. Datesmon reported on his visit to European works. He stated that "the trend of new designs or where extensions must be made to old works is divided between fine screening and additional tankage.

"In one case, Dusseldorf tanks were determined upon for extension works after exhaustive tests and calculations as being more economical than screens, and the type chosen was the Emscher, on account of efficient sludge disposal.

"The cleanest, most economical screen is the Reinsch screen used in Dresden, with the Frankfurt a/M. type of 5 vane rake a close second.

"Screens, however effective in many cases, cannot compete in efficiency with properly designed tanks.

"While the data is not in such form as to be readily comparable with tankage systems, it can well be asserted that of all the screens in use that at Dresden gives the highest efficiency, which is 64 per cent. removal; others are less than one-half this, as a matter of judgment.

"By comparison tankage treatment is more effective in the removal of solids than is screening.

"In addition, tankage treatment is more flexible, in that longer storage will remove more solids.

"The argument is advanced that screens take less room, can be confined to a building, while tanks must be subject to climatic changes and variations in character of sewage, also that more land is required.

"From observations, it would appear that the extra cost of land is more than offset by first cost and operating cost of screening machinery.

"Where, therefore, the flow in a river is sufficient to afford proper dilution for the sewage and screening alone is necessary, as at Hamburg, the use of fine screens is of advantage owing to the ease of handling the screening, the ability to confine the treatment to a building, which may set in a populous section without nuisance, and thereby avoid the cost of long conduits and large areas for sludge storage.

"Where other conditions prevail, the rivers being inadequate to furnish proper dilution, tankage treatment appears to be advantageous in place of screens."

Efficient Conduct of Building and Contracting Operations

By Grant Fee *

WE are not moving forward at the present time in the general sense of the word, but we are going by leaps and bounds. In the science of construction and in mechanics we are advancing at a rate which twenty-five years ago was not deemed possible.

The Woolworth Building, located in New York City, has a height of 792 feet, has 55 renting stories, has a floor space of 40 acres. This building was constructed complete in less than two years. This is an accomplishment which for gigantic proportions and economy of time well nigh staggers the imagination. The commercial value of a structure of this character is made possible by the invention and construction of high speed elevators with the necessary practical safety devices.

The Twin Peak's Tunnel, which is now being constructed in San Francisco, has a length of 2¼ miles, a width of 25 feet in the clear, has two large sub-stations or chambers with necessary approaches. This work will be completed in less than two years.

The Panama-Pacific International Exposition has a total ground area of 635 acres; of this 330 acres are covered with buildings, or are under roof. In its construction over 110,000,000 feet of lumber, over 120,000 tons of steel, thousands upon thousands of tons of plaster and other materials in proportion were used, together with the salt water fire system, the fresh water system, the sewer system, the electric system, the streets and driveways, and the parking and planting; the grading for streets was commenced in October 1912, and all work was completed in February 1915, making the time for completing this gigantic undertaking less than two years and five months.

In the construction of the Panama Canal, the most gigantic undertaking in the world, over 200,000,000 cu. yds. of earth and rock were removed; 5,000,000 cu. yds. of concrete used, and half gates in the locks were used which have a weight of 700 tons each. This canal was completed in ten years and eight months by the United States Government. To perform this work special appliances and machinery were designed by General Geo. D. Goethals, who had complete charge of this great work; he is the greatest American builder to-day, and it was Gen. Goethals who made this very celebration possible. It is our loss that it was not possible for him to accept our invitation to be present with the American builders during this Congress.

These are forcible illustrations of modern efficient methods.

In mechanical lines, new machinery to perform new work is being designed and constructed so rapidly that efficient machines of last year are inefficient this year, due to other better inventions or the urgent necessity for new methods.

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* Before American Builders' Convention, San Francisco.

Referring to the building industry in particular, the invention of machinery and appliances for the direct and economical manufacture of the various articles necessary to construct a building, and for conducting the actual building operations on the site, have resulted in increased efficiency to such an extent that at the present day a building can be, and is, constructed in a much shorter period than would have been required even twenty years ago.

The wonderful possibilities of these days for manufacturing the hundred and one materials which enter into the construction of a building, enable us to perform all work in shops or factories, excepting the actual erecting or assembling of such materials on the site, thereby effecting a saving of time and money.

Economic Value of Modern Machinery

The economic value of modern construction hoists and elevators, mechanical mixers for various materials, pneumatic tools for riveting, drilling and boring, the use of electric power and electricity for welding and cutting, power saws, power surfacing machines, swing staging for exterior work, preservative coatings for stone for excluding moisture, thus making stone work look better and last longer, the making of concrete practically water tight by the admixture of hydrated lime and waterproofing compounds, and the one thousand and one machines, compounds and materials, which have been invented for various uses, all combine toward increased efficiency to make it possible to construct a building quicker and better than ever before.

The revolution of construction methods by the introduction of the modern steel frame, reinforced concrete frames, reinforced concrete for wall and floor construction, mill construction and other methods, all tending toward increased fire protection, are other forms of greater efficiency.

The improvements made in the past twenty years in our factories, now well lighted and sanitary, and in our shops on the building site, essential to the health and comfort of workmen, as well as in the mechanical part of the construction of buildings, are marvelous.

The Efficiency Expert

The efficiency expert of to-day employed by a manufacturer to go through his factory, study its workings, in the hope of increasing its output with the same or less expense, does not enter the factory with the idea of causing the employees to expend more personal energy in order to increase the output, but with the idea of studying the various operations of the factory, locations of machines, etc., in other words, his aim is mainly to save waste, to introduce system and arrange the machinery in such a manner that the energy expended by the employees is always expended toward greater efficiency or better production and not in unnecessary motions, or similar unproductive labor. It is simply an effort to save waste of time, material and energy.

There is too much apathy in our business. We should inform ourselves, as far as possible. **Let every man in the business read the excellent Building Trade papers of to-day.** There is something to learn every day. Why should not education supplement the trades we learned when young. The world does not remain still, men cannot afford to do so. If we do not progress we go backward, and it is our duty to keep abreast with the advancing strides in building matters and modern methods.

Now let us consider for a moment a very important question: Have we made the same progress in that part of our work which is non-mechanical,—for example, Estimating?

No Progress in Estimating

We have not, in my judgment, made any material progress in the efficiency of estimating for the past twenty years, perhaps longer. Our present method of obtaining contracts is much the same as it was twenty years ago, and I believe we could go much farther back than that.

No matter how many men or firms are figuring a building, each takes off his own quantities and figures accordingly, and here it may be said the time allowed for determining the value of work is now, generally speaking, too short. Some one has said accuracy is too often sacrificed for speed. Present methods are conducive to error, and resulting complications. Estimating as it is now done entails an immense amount of wasted time and energy, as one individual could take off the quantities ready for pricing, whereas twenty, perhaps, are doing the same work, all going over the same ground. The builder in the various lines wastes a great deal of his own time, and the time of men in his employ in taking off quantities for estimating. If this wasted time could be devoted to supervising actual construction work in hand, it would be much better from the standpoint of efficiency, and incidentally, more profitable. The builder may not add a particular item for the wasted time and energy in an estimate, but in the overhead cost of the various buildings he does; it becomes a serious item of office expense, and therefore, must be, and is, paid for eventually by the owners, although under our present methods he may never realize this fact.

It appears to me that we are wanting in efficient methods in this particular. Owners now pay in the end many times over for taking off the quantities of a building; this would not be the case if one well trained person were to take such quantities off, and duplicate lists of these quantities furnished to each bidder as a uniform basis upon which to figure.

This would help to reduce the cost of construction in the sense that a builder would be able to devote more time to the work he has in actual progress. He would have more time and a clearer mind with which to consider the numerous questions which always arise in carrying out work; greater efficiency and less waste would result.

A Quantity Surveyor

It would seem to me, therefore, the creation of a licensed office—known as the Quantity Surveyor—is desirable. Men who have special training in this work and who are responsible and competent. The plans and specifications would pass into his hands from the architect. His duty would be to prepare a Bill of Quantities of the various materials required for the construction of the building. This Bill of Quantities, with the plans and specifications to be submitted to the various bidders who are to figure on the work. The plans and specifications to indicate the conditions under which construction will take place, height of building, character of work, etc., and the Bills of Quantities to indicate the quantity of material of all kinds which the successful bidder is expected to furnish. The Bill of Quantities I consider should be made the basis of the contract entered into between the builder and the owner. Should more materials be required the Builder to be paid for same at his own unit rate, and if less materials are required, then same to be deducted from the contract at the unit rate. Would this not result in a great saving of energy and time now wasted, and result in a better understanding between all parties?

This would require plans from the architect more complete than those generally furnished at the present time for estimating. It would require plans showing the locations, sizes, etc., of all electric conduits, heating, gas, sewer, plumbing, vacuum cleaning pipes, etc. It would be necessary for plans to show the actual construction contemplated in various parts of the building, not leaving such matters to the judgment of the builder when estimating, and to the interpretation of an architect after a contract is awarded.

The Element of "Guess"

At the present time when estimating, a bidder must make some allowance for conditions and things not clearly shown by plans and specifications, thereby adding a certain cost to the building under our system. Were this element of risk or guess-work eliminated it would have a still further tendency to reduce cost of construction to the owner, and the builder would not be called upon to take those unfair chances which make bidding so uncertain to-day.

Payment according to measurement is nothing new, it has been used in older countries for a hundred years nearly. Mr. G. Alexander Wright, a prominent architect of San Francisco, has, during the past twenty years, done considerable work in an attempt to establish better estimating and contract methods, urging and advocating better and fairer methods and the adoption of the Quantity System of estimating, upon which he is a well-known authority.

Some builders seem to be opposed to change in our system, holding that, if the position be changed any one from a candle-stick maker could become a contractor; therefore, the business would become over-crowded and would not be a profitable business in which to engage. I believe they are mistaken. There is nothing to prevent that now, and, unfortunately, we know it does occur. It appears to me that profits are not the result of our system of estimating. I believe our system is responsible for the losses, because it is impossible for a bidder, in the hurry generally necessary in taking off quantities, to accurately and intelligently do such work, for several reasons, consequently he must use his building instinct and judgment to guess "right" in greater or less degree in making up his estimate, and it is through resulting errors and by omitting quantities altogether, that losses occur.

Great Variation in Tenders

The great variation in figures submitted for buildings, in my judgment, is due not to the unit prices used, but is due to the difference in the quantities each bidder takes off. This variation in quantities is due in part to work not being shown with sufficient clearness on plans, and in part to the difference in the judgment of the various men taking off quantities, time being usually too short, and consequently under our present unscientific inefficient methods of estimating, there must be more or less guessing as to the quantity of materials required.

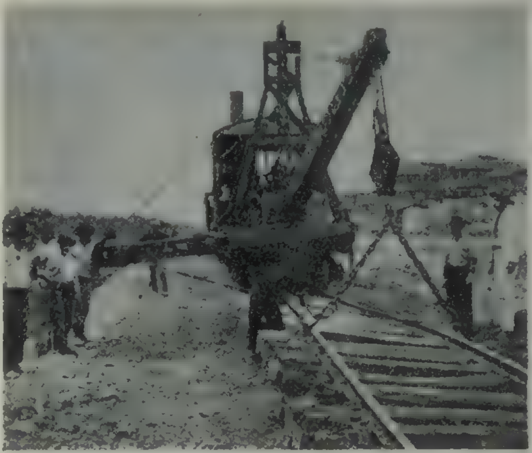
The profit in building,—when there is any,—is due rather to the ability of the builder to buy materials at the best market price and to his efficient methods in conducting his operations and managing his business.

I believe the quantity system, or some method of payment based on the quantity of work actually executed, would make the business more profitable to the builder, less costly, and therefore a better investment for the owner. As I view the situation to-day, our estimating methods are unscientific and inefficient, and a change is necessary if we really desire efficiency in the estimating department of our business. I believe that it is the duty of every building organization to make a concerted effort to correct the present unsatisfactory contracting conditions.

Machine Built at Panama Canal Shifts Track on Dumps

The main dumps for disposing of excavated material on the Panama Canal were started from trestles constructed for the purpose, and when filled out as far as the spreader would reach the track was shifted to one of the edges of the dump. The track-shifter illustrated herewith was devised on the Isthmus for this work and was described in a paper presented to the International Engineering Congress in San Francisco last month by Maj.-Gen. George W. Goethals, governor of the Canal Zone.

The track-shifter consisted of a boom, with suitable tackle, extending from a flat-car out over the track in advance of the flat-car, which lifted the track bodily, ties and all, from its bed. Another boom, lying in a practically horizontal position, and also equipped with tackle, extended out at an angle to the side of the car, and was used for pulling the track to one side or another. For operating the booms, the car was equipped with an engine similar to the ordinary hoisting engine. At first the track-shifter only moved a section of track 5 ft. sideways at a time, but it was later improved so that the track could be thrown over 9 ft. at one operation. On one occasion, at the Tabernilla dump, 1¼ miles of track were shifted 12 ft. from the original position in 1 hr. and 50 min. Ten of these machines were made on the Isthmus and used on the work. To facilitate this track shifting, the track had one free end and was made more flexible by an occasional switch-point in laying the rails.—Engineering Record.



Shifts track 9 feet at a time.

Concrete Construction Stood the Test

One of the most severe tests of concrete fireproof building construction in Canada of which we have record took place on the afternoon of November 5, when the complete stock of the United Photographic Stores, Limited, located on the fourth floor of the Read Building, Montreal, was destroyed by fire. The stock consisted of chemicals, films, and a general stock of light and inflammable materials used in the manufacture of photographic supplies. The nature of the material burned was practically the same as that which was destroyed in the Edison factories in December last, when the fire was reported to be one of the hottest known.

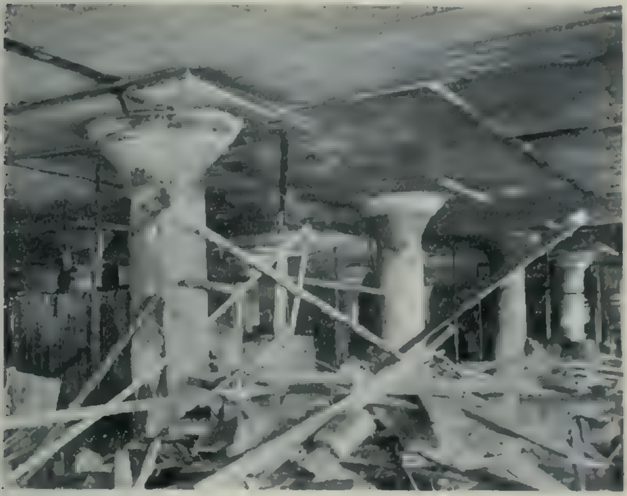


Fig. 1.—The floor on which the fire started.

The fire in the Read Building was discovered about 2.40 p.m., and rapidly spread to all parts of the company's space in the building, members of the company's staff stating that the entire floor was a mass of flames in a few minutes. The fire alarm was received by the brigade at 2.44 and the flames were fought continuously for one hour and thirty minutes. During this time eight engines were in use, and the following streams were used: 24 attached to the engines, one water tower with three streams in one, three turret wagons with two streams in one, one siamese stream, and three streams in one, making a total of 29 streams.

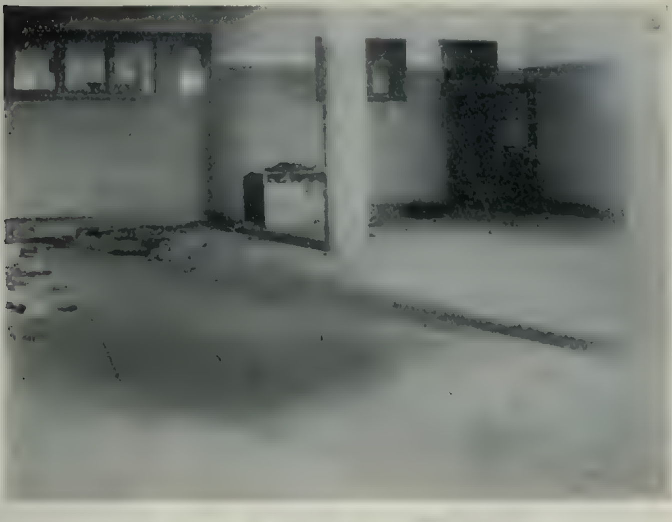


Fig. 2.—Floor above where fire started.

An examination after the fire showed that no portion of the concrete itself was damaged. The plaster coat on the concrete used in the interior finish of the building was peeled off in a very few places, and the wooden frames and sashes of the windows were destroyed. The fire was confined entirely to the floor on which it started, and no damage was done to any of the floors above, except that the glass in a few of the windows in the floor above was broken by the water streams from the hose. On the floor beneath the only damage done was that caused by the water used to extinguish the fire flowing down the stairways and elevator shaft. Naturally a large quantity of water was used, but none of this passed through the floor into the offices below. Photographs taken on the following morning some of which we reproduce, showed the condition of the fourth floor and its contents after the fire, and also the condition of the floors above and below. The 350 people in the various offices and factories all succeeded in getting out safely by the passenger elevators and stairways.

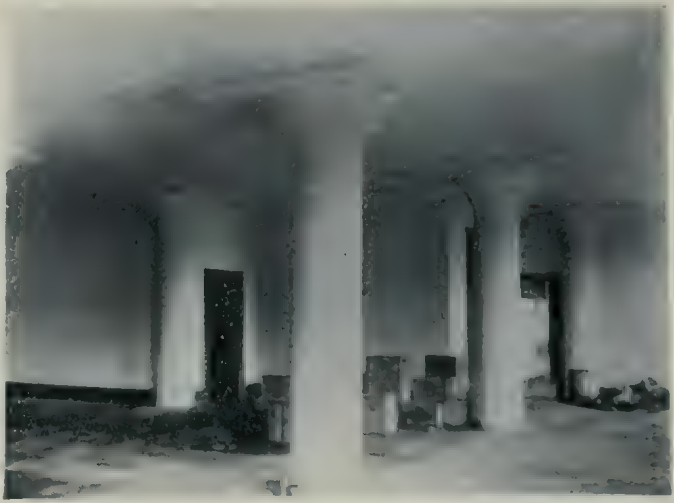


Fig. 3.—Floor below where fire started.

The Read Building was constructed in 1913 by the George A. Fuller Co. Limited, the concrete work being done by Church, Ross & Co., Ltd. The architects were Ross and Macdonald. The type of construction used is the Mushroom system of reinforced concrete. The entire frame and all the floors are of concrete, the curtain wall and outside finish being of brick. No wooden floors are constructed on top of the concrete.

With the exception of the floor on which the fire occurred, all the floors were occupied the following day for business purposes.

The fire in the Read Building is another illustration of the fireproof properties of concrete structures, but it also demonstrates the fact that, in the view of many people, no building, no matter how fireproof, should be built without a sprinkler system, steel sash, wire glass windows, and partitions which are fireproof. None of these was provided in the building, and consequently there was nothing to check the

(Concluded on page 1196)

Characteristics and Application of Explosives

By R. M. Smith, B. Sc.

THE value of explosives is derived from the volume of gas generated upon detonation or explosion and the speed at which the generation takes place. The pressure of generated gases is equal in all directions (contrary to general belief of some practical men that dynamite strikes down). The explosives in common use in Canada are very few. Practically the average foreman is acquainted with only two kinds, black powder (gunpowder and blasting powder), and some of the ordinary varieties of dynamite. Many explosives are being used in Europe which deserve consideration, but for the most part the quarrymen of Ontario have been content to use the explosive they are acquainted with and accustomed to handling. Dynamite is sold at a cost which probably prohibits, to a certain extent, the marketing of other explosives. The results with dynamite have been such in the past that we are more concerned with improving these, than experimenting with new explosives.

The explosives are divided in the following manner: (1) gunpowder, (2) nitrate mixture, (3) nitro compounds, (4) chlorate mixture, (5) fulminate.

The Nitrate Class

The best example of this is gunpowder. The characteristics of these explosives are that they consist of mechanical mixture of nitrates with some base containing charcoal or other substance yielding carbon. The nitrates carry the oxygen which combines with the base under favourable circumstances, developing a large volume of gas at a high temperature, and if the powder is confined at the time of explosion there will be produced an enormous expansive effort.

The standard composition of gunpowder is:

Potassium nitrate (nitrate of saltpetre)	75 parts
Charcoal	15 "
Sulphur	10 "

Black powder, as stated above, is a mechanical mixture; it consists of a finely pulverized sodium nitrate intimately associated with combustible materials. This intimate association of materials is brought about by thoroughly mixing and incorporating them in what are termed "wheel mills." The product is pressed into hard cakes, which are subsequently broken into smaller grains. The powder is then put in a revolving barrel where grains are rounded by rubbing together and at the same time coated with graphite, and known as "glazed." The object of glazing and rounding the grains is, that the powder runs easier and is not affected so much by moisture. The powder is divided into sizes according to the diameter of grain. One volume of powder on exploding expands 400 times, normal temperature and pressure. At the instant of explosion gases are highly heated, and tend to occupy a much greater volume than at normal temperature and pressure.

The rate of detonation, explosion, or burning, as stated before, determines the efficiency of the explosive and offers the best basis for selecting explosives suitable for various conditions. The shattering effect of sudden pressure on a given substance is very different from that produced by an equal pressure applied slowly. The quicker the rate of explosive reaction the more pronounced will be the shattering effect. The shattering effect of a commercial explosive depends on its rate of detonation. The more nearly instantaneous the explosive reaction for a given explosive, all other conditions being equal, the greater is the volume of highly heated gases it produces in unit time and the more violent the effect it exerts.

Black blasting powder, under conditions that exist in a drill hole, has been found to burn at a rate of 1,538 ft. per second. This rate is slow compared with that of "ordinary" dynamites. Blasting powder is best suited for work requiring a pushing or heavy effect. The gases from the combustion form at such a relatively slow rate that the pressure produced is prolonged, and there is a corresponding loss of heat and pressure produced from conduction and radiation. In order to obtain maximum efficiency with black powder the charge must be well confined by suitable tamping. The best results are obtained when drill-holes are tamped to the mouth. Black blasting powder is used in excavating cuts, quarrying soft rock or stone, and especially in quarries when large blocks of building stone are required. In some work it is necessary to spring the holes to get sufficient room for large charges of powder, and in this case it is well not to load too soon after springing, as the heat may explode powder prematurely.

Nitro Compound

Dynamite is the most largely used of any blasting material. It was invented in 1866 by Alfred Nobel. The principle consisted of using an absorbent commonly called a "dope" which would take up the nitro-glycerine and hold it somewhat after the manner of a sponge. German earth called Kilselguhr, powdered "rotten stone," or similar porous material may be used. These materials are known as inert bases. Instead of these inert bases, active bases may be used. Gunpowder, guncotton, etc., are examples ef these bases. Dynamite is then known under several names, depending upon percentage used—giant powder No. 2, rendrock, carbonite, dualin, hercules powder, gelegnite, forcite, etc.

It is not the purpose of this paper to go into the composition and manufacture of these explosives separately; it is sufficient to say that nearly all have been used with success. Dynamites are known according to the percentage of nitro-glycerine they contain—30, 40, 50, 60, etc.

There are certain requirements which all dynamites should fulfil, and it is the duty of all persons using them or handling them to see that they do not fall short of the proper standard. Good dynamite should not feel greasy. There should be no trace of free nitro-glycerine inside the wrapper of the cartridge. In order to test this point, lay one of the suspected cartridges on a sheet of clean brown paper in a room at from 60 deg. to 80 deg. F., for a period of 12 hours. If the cartridge has begun to "leak" nitro-glycerine, this will be shown by oily discoloration on the brown paper. Dynamite properly made should be proof against leakiness under normal conditions of temperature and moisture. To test its quality in this respect two separate determinations should be made. First freeze and then thaw sample of the dynamite three successive times and test for leakiness as explained above. Second, expose samples to a temperature between 85 deg. and 90 deg. F. for six consecutive days and again test for leakiness. In neither case should any trace of free nitro-glycerine be seen on the brown paper. Dynamite slowly heated explodes at 356 deg. F., and if rapidly heated it explodes at 446 deg. F. Some dynamite will explode at even lower temperatures than these. Near the freezing point (42 deg.-46 deg. F.) dynamite is very sensitive to shock or friction. Frozen dynamite is not sensitive to ordinary shock, but is slightly so to friction. It may be exploded with a very powerful detonator. Exposure to the rays of the sun, especially if transmitted through window glass, is liable to produce decomposition and explosion. A strong electrical discharge or a flash of lightning will usually explode dynamite. If the dynamite upon examination has a whitish crust it is no longer safe; this is a sign of dampness. Greenish spots also indicate that nitro-glycerine has started to decompose and is therefore unsafe. Dynamite placed in water gradually parts with nitro-glycerine, its place in the cartridge being taken up by water. In wet conditions, therefore, it should be fired as soon as possible after charging, and in no case should be allowed to remain unexploded several hours, as nitro-glycerine may leak out and find its way into crevices, where it may cause accidents later.

Nitro-glycerine, if properly purified, should have no tendency to decompose if kept at a temperature below 110 deg. F. It may be destroyed by spreading over large areas and burning, or by chemical action. The volume of gas produced upon explosion compares with gunpowder in the ratio of 13:1.

Nitro-glycerine is said to burn at rate of 14,920 ft. per second.

Detonators

The explosion of blasting powders is accomplished either by the direct application of a high temperature, unaccompanied by a shock, as in the firing of gunpowder by a fuse, or by the application of a very powerful shock in which the high velocity of the explosive wave is of more consequence than the temperature, as in the explosion of dynamite by caps or detonators loaded with fulminating compounds. The detonator may be exploded electrically or by fuse. Safety fuse consists essentially of a powder-thread spun around jute yarn, and impregnated with composition to make it waterproof. The rate of burning is about 1 foot in 30 to 45 seconds. It should be remembered, however, that this use is only moderately waterproof. For blasting under water special gutta-percha covered fuse is manufactured. Safety fuse is sold at about $6.00 per 1,000 ft. In order to accomplish simultaneous firing of a number of holes with fuse instead of by electricity, quick burning fuses are made by coating a wick with meal powder paste having yarn loosely spun over it. The several fuses of equal length are attached to sheet iron connector, in one end of which is a disc of powder and a perforated wooden plug for the insertion of an ordinary safety fuse. This fuse has only limited success in the United States, and has not been introduced into Canada. In military work an "Instantaneous Fuse" is used successfully. It is fired in the same manner as described above.

For use with high explosives a detonating cap is essential in order to impart a sufficient initial impulse to develop the full strength of the powder. Detonators contain the powerful explosive, fulminate of mercury, which is enclosed in a copper tube out of contact with dynamite. The detonation of the fulminate pulverizes the end of the tube so that the temperature resulting from it is communicated to the explosive, but it is the vivolence of the shock that is relied upon to start the detonation of the high explosive.

(Concluded in Nov. 24th issue)

Sun-Power Plant at Meida

Mr. W. Ingham, M. Inst. C.E., former Water Engineer at Torquay, and now Chief Engineer of the Rand Water Board, South Africa, recently delivered his address as President of the South African Institution of Engineers. He described the sun-power plant erected at Meida, near Cairo, for raising water from the Nile for irrigation purposes. He also gave interesting facts relating to extensive waterworks in England, mentioning that the capital cost of the Derwent Valley scheme for supplying Sheffield, Derby, Leicester, and Nottingham had been £3,500,000, and that the capital expenditure up to April of last year on the water supply of London amounted to £48,728,930.

Railway accidents in Germany in 1914 have been compiled and analyzed by the Association of German Street and Interurban Lines. This association embraces 178 lines, which during the year operated 750,000,000 car-km. (460,027,460 car-mi.) and carried 2,750,000,000 passengers. Accidents averaged one of a serious or fatal nature for 349,103 miles operated. In Aix-la-Chapelle, which has the largest interurban system in Germany, the average was one accident for 402,166 miles. The fact that more pedestrians were injured or killed than passengers was established as usual. The association, taking an average for the 15 years from 1899 to 1914, states that 31.81 per cent. of the passengers injured suffered accidents through carelessness while boarding or leaving cars. Of the pedestrians injured, it reports that 54.46 per cent. were careless in crossing or walking along car tracks.

The sixth concrete crib used in the construction of the piers in the Victoria harbour improvement scheme is now under construction and will be launched from the marine ways in the near future. Since the first two cribs were constructed on a floating drydock, marine ways were built to accommodate four cribs simultaneously and three have been successfully launched by the new method. Since the commencement of the work the following items have been completed: Earth excavation, 31,940 cu. yd.; rock excavation, 20,183 cu. yd.; rubble foundation, 365,699 tons. have organized a road engineering staff under Mr. John L. Feeney, and a systematic effort is to be made to improve the character of the highways of the province. A beginning has been made on the road between St. John and Rothesay, and also upon the St. Andrew's Road.

Mud removed from St. Louis water in 1915 amounted to 358,000 tons. To accomplish it required 13,650 tons of lime and 6770 tons of sulphate of iron. The sterilization process utilized 28 tons of liquid chlorine.

National Steel Car Co. Manufacturing a 3½-ton and a 2-ton truck

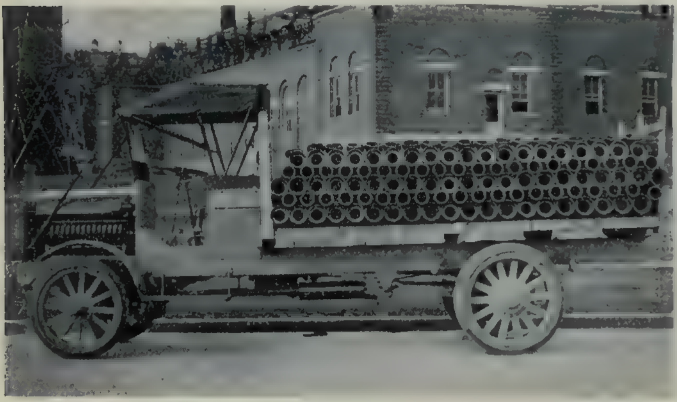
WE illustrate herewith a three-and-a-half-ton truck manufactured by the National Steel Car Company, Limited, of Hamilton, and at present in use by the Toronto-Hamilton Sewer Pipe Company in Toronto. The National Steel Car Company are also turning out a two-ton truck of similar specifications. The chief specifications of these cars are as follows:—

Specifications

Motor—Waukesha, cast in pairs, 4 cylinder; bore, 4¼ in. and 4½ in.; stroke, 5¾ in.; valve diameter, clear, all models, 2 in.; connecting rod bearing, 2 in. x 2½ in.; gear end main bearing, 2 in. x 2 7/16 in.; centre end main bearing, 2 in. x 3¼ in.; fly wheel end, main bearing, 2 in. x 3½ in.; piston pin bearing, 1¼ in. x 2⅛ in.; camshaft diameter, 1¼ in.; timing gears, helical pitch, 10; timing gears, face, 1; S.A.E. spark plug thread, ⅞ x 18.

Transmission Company's own design, made by the Covert Mfg. Co. 2 and 3½ ton models, 4 speeds forward and a reverse. Transmission is placed midway between rear axle and motor.

Clutch—Enclosed dry-plate variety.



3½-ton truck of National Steel Car Co.

Ignition—Dixie Bosch or Eiseman, high tension.

Carburetor—Zenith. Control by hand throttle at top of steering post and by accelerator on toe board. Transmission control and emergency brake levers are in centre and steering wheel is placed to the right or left at the option of the purchaser.

Radiator—On both models of built-up type, having cast top, bottom and sides, enclosing fin and tube centre core. Directly behind the radiator is mounted an 18 in., high efficiency fan. Water is forced by a centrifugal pump. The radiator core is approximately 575 square inches, cross sectional area.

Steering Gear—Worm and nut, fore and aft type, made by Ross Gear & Tool Co. The trunion shaft carrying the pitman arm is of heat-treated, nickel steel, 1½ in. in diameter. The pitman arm is a special, drop forging. Hand wheel has aluminum spider 20 in. in diameter.

Front Axle—Timken 2 x 3 in. I-beam section.

Rear Axle—Timken, David Brown worm drive. The driving strain is taken through radius rods attached to rear axle and frame.

Springs—Semi-elliptic front and rear, of silico-manganese steel, self lubricated. Front springs are 48 x 3 and rear springs are 52 x 3. All spring-eyes punched.

Wheels—Best oak of artillery design with squared spokes, 14 to the wheel. Front wheels 36 x 5; rear, 40 x 5, dual.

Tyres—36 x 5 in. front; 40 x 5 in. dual, rear; solid rubber and demountable rims.

Frames—High carbon, open hearth ship channel. Cardan shaft is tubular, made from seamless, drawn steel tubing of .35 carbon steel, heat-treated.

Equipment—Three Adlake pressed steel truck lamps, jack and a full set of tools.

Oxy-acetylene Welding—an Efficient and Economical Process Growing in Favor with Contractors

In The Contract Record of date October 20 a brief description of the uses of the oxy-acetylene equipment in "cutting" were discussed. In the present issue we will deal briefly with the use of the same equipment in "welding." The use of the oxy-acetylene flame in welding in the contracting business is not as yet so well known as in cutting, but there are many applications for the welding process in this trade, and the number of contractors applying welding as well as cutting is steadily increasing.

What is oxy-acetylene welding? It is the joining by fusion of two pieces of metal brought about by the flame of a blowpipe. It is different from blazing or soldering; these two terms mean the joining of two metals by the interposition of a foreign substance, such as brass spelter between two steel plates, or tin between two brass pieces. Welding means the actual melting together of the edges or ends of the two pieces to be joined—whether steel, cast-iron, brass, bronze, copper, aluminum, or other metals—a process which results in a joint having practically the same properties as the metals joined, and with practically the same resistance.

This process is only possible, of course, with a very hot flame, and one which changes the properties of the metals to the least possible extent. The oxy-acetylene flame fulfils these requirements in a very satisfactory degree. A temperature as high as 6,300 deg. Fahr. is obtained, and the gases, oxygen and acetylene, do not affect the metals if their proportions are properly regulated.

The instrument used for applying the oxy-acetylene flame is a specially constructed blow-pipe, and suitable welding rods are employed for filling the gaps or chambers which have to be prepared on the edges of the two metal pieces. An apparatus well adapted for "cutting" in contracting work was shown in our October 20 issue. It is specially suitable on account of its portability, and can be used for both cutting and welding—a different kind of blow-pipe being used, of course, for the two operations.

The cost of welding is not great. Each 1/16-in. thickness in steel plate requires about 25c to 30c worth of gas per hour, the speed of welding being, for instance, about 30 feet per hour for sheet steel 1/16 in. thick, about 5 feet per hour for ¼-in. thickness, and about 1½ feet per hour for a ⅝-in. plate.

The advantages claimed for oxy-acetylene welding are, first, that the work it does is permanent. It often shows more resistance to fracture than the unwelded portions, and is stronger than when riveted, patched, overlapped, caulked, brazed, or soldered. It follows that these welded joints can be successfully subjected to high pressure, shocks, and heavy vibrations.

Further, repairing may be done with the oxy-acetylene apparatus which could scarcely be done at all by any other process—as, for example, reclaiming the inner wall of a cast-iron motor cylinder, where patching or riveting would be out of the question.

The element of time saved is also an important one. Heavy pieces of machinery can be repaired right on the ground, thus obviating considerable delays and expenses in transportation. An example of this is the welding of cracked pipes in mines. Another example is the repair of a cracked automobile steel frame without dismantling. Considering all this, welding means cheaper, quicker and neater work.

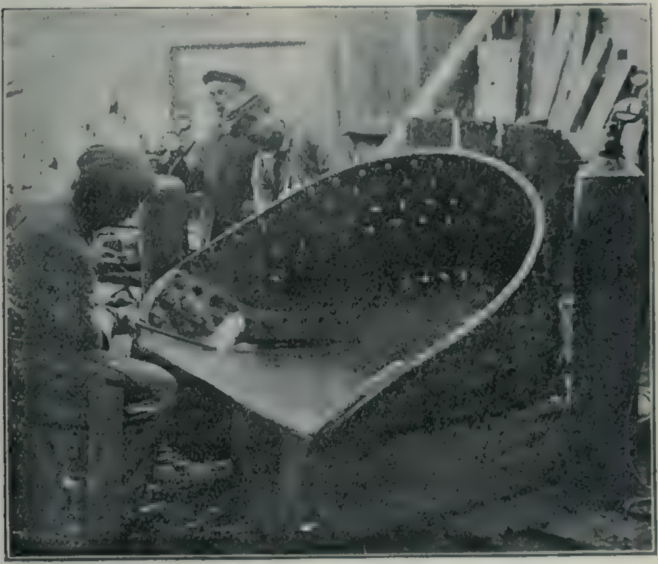


Fig. 1.—Adding metal on worn-out dredge bucket.

The oxy-acetylene welding apparatus has been found of very universal application in the contracting and building trades, a few of which are mentioned below.—

Reinforcing bars for concrete work can be made up to continuous lengths. Holes drilled in error in beams or pipes are quickly filled up. Tees, drips, reducers, fittings, and so on, are quickly welded on the main steel or iron line. Water-tight and rigid steel forms for concrete work are easily prepared. Steel gas and water mains may be assembled into continuous lengths by this process; these are cheaper to manufacture than flanged pipes, are absolutely tight, are light and flexible, and demand practically no maintenance.

In Europe and in the United States many miles of welded steel mains for gas and water are in use.

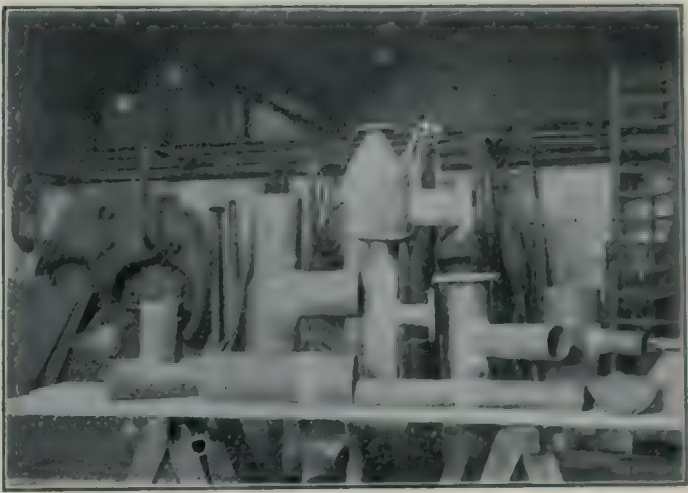


Fig. 2—Tubings and fittings welded by oxy-acetylene flame.

Welding smokestacks also means a saving of money; these are rigid, light, and very neat in appearance.

Almost countless repairs may be carried out by the welding of worn-out or cracked parts of dredges, crushers and mining engines, such as dredge buckets, gears, wheels, pulleys, connecting links. Worn-out rails, carrying trucks, locomotives, and electric cars in contracting work, may be reclaimed by building on new material. Defects in boilers, such as cracks or corrosions, may be easily remedied.

Oxy-acetylene welding holds a prominent place also in other lines which are closely connected with the contracting business. For example, the ornamental-iron industry employs the process successfully for assembling the pieces forming part of a balcony, a staircase, a cornice, or a door. In the plumbing business, miles of welded steam-pipes are nowadays employed. Welded radiators, stoves, ovens and hot-water boilers, are in continuous use, and so are welded tanks, vats, and receivers, which are tight, light in weight, cheap to manufacture, and neat in appearance.

Experience has shown that many a welding plant has paid its initial cost on one job alone. When once the apparatus is at hand, work is found for it every few hours, and the amount of time and money saved is a considerable one. It may be mentioned that there are no difficulties in the way of obtaining sufficient quantities of oxygen and acetylene. The principal cities of Canada carry them in stock, as well as complete made-in-Canada plants.

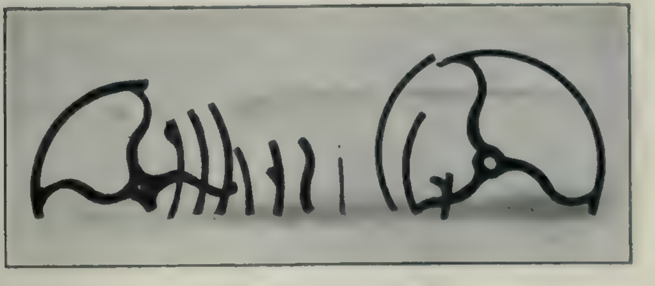


Fig. 3—Pulleys before welding

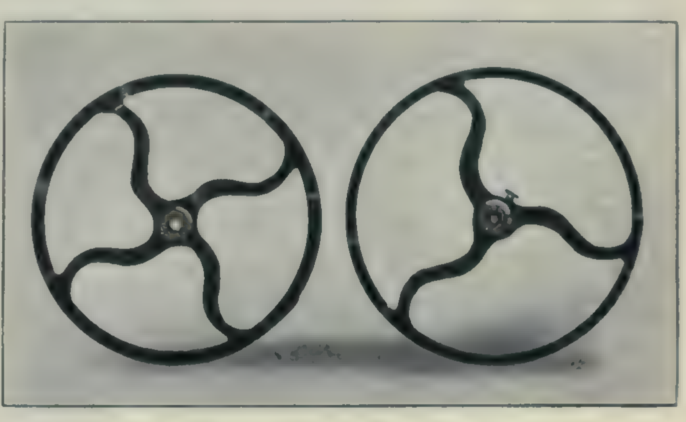


Fig. 4 -Same pulleys as in Fig. 3 after welding.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

The United States mourns and refuses to be comforted because Britain is restricting her trade. Let our cousins gather what sunshine they can from the fact that prosperity is returning to their country, aided and abetted by sundry munition contracts and war prices for their wheat.

* * *

Here's hoping President Wilson in his excitement doesn't get his notes mixed and send the Kaiser one of those intended for his fiancee. Well now after all the mistake mightn't be noticed.

* * *

Canada for the first time in her history is selling more than she buys. That spells prosperity. The war is costing a lot of money and its conclusion promises to find this Dominion deeper in debt than ever, but with more money to pay its debts than ever before.

* * *

That Sir Robert Borden expected more from his shell committee goes without saying. It is whispered that in the interview with F. P. Jones, the Premier scoffed at the idea that shells could be produced at the price quoted in Mr. Jones' tenders. But when the latter came back by posting a marked cheque so large that it left no room for argument the days of the then Shell Committee were numbered. And recent Ottawa despatches indicate that Mr. Jones has gathered in about $7,000,000 worth of these new contracts. Also he has the satisfaction of having been a real benefactor to Canada and to the Empire.

* * *

If the United States needs further proof that the blockade of German ports by the British navy is of the good old-fashioned variety it has only to apply to its ambassador at Berlin. He wants said blockade raised till he can get shoes, haberdashery, chewing tobacco and gasoline. There is nothing imaginary in a blockade of that kind.

* * *

Patriotism is the last refuge of a traitor and, though I would not like to go so far as to place some leading Liberal journals in the traitor class, it is rather amusing to contrast their present ebullitions of patriotism with their utterances of a few short months ago. When Premier Borden came back from England, declared the German peril real, and asked parliament to make a cool appropriation of $35,000,000 to the British navy, he doubtless knew that war was imminent. He also doubtless imparted this information to Sir Wilfred Laurier. But did the man who thumps his chest and claims "a British subject I was born," etc., rise to the occasion and give a practical demonstration of his patriotism? On the contrary he opposed the appropriation in the House and strangled it with his Liberal majority in the Senate. And the while these ultra-loyal Liberal journals shouted their applause. Now they jump to the other extreme and are madly impatient because the Government is not equipping soldiers fast enough and is not furnishing more troops than the Mother country asks us for. It pains me to say it, but one cannot help wondering whether this is pure patriotism or if it is not mixed with a slight desire to embarrass the Government and make political capital for use in elections.

* * *

The French Commercial Commission, which has just arrived in New York, will spend a cool billion for machinery, war supplies and foodstuffs. Will the Minister of Commerce kindly tell us what steps are being taken to ensure that Canada gets her share of this business For you know our Minister of Commerce can make a rattling speech and as a financial critic he is in a class by himself. But as the man on the corner remarked "that line of stuff don't get us anywhere." A certain line of action that would bring results would be to some purpose.

* * *

The curse of Canada is too much politics. Every cabinet must have its party fence builders as well as its nation builders. The former are supposed to keep the party in power, while the latter do their work. But history shows that nearly every government Canada has seen has gone down to defeat because of the crude work of some of its "practical politicians." On the other hand the late Sir James Whitney adopted as his policy a blunt honesty that apparently cared not who it huffed or hurt. Coming as it did after the political trickery that finally resulted in the downfall of the Ross Government it was refreshing. Perhaps, after all, honesty is the best politics. It is the practical politician who must oil the party machine and while engaged at this messy job he generally succeeds in spilling enough oil to grease the skids on which his party slides into opposition.

* * *

And it is something more than a rough guess that the practical politicians had a finger or two in the shell game. It will be noticed that the shell committee was made up of a harmless board of a couple of manufacturers and a batch of government employees. The manufacturing members would probably not be too inquisitive as long as certain factories got their share of the contracts and the government employees could be depended on to do pretty much as they were told. With this combination, a certain secrecy and an expressed desire to spread the contracts so as to cover a commercial depression caused by the war, it was an easy matter to place the contracts where they would do the most good. Most of those contracts were given to the little fellows. Men with big propositions were given no encouragement at Ottawa. One responsible man who made a proposition to enlarge and equip an already large factory and turn out shells in quantities was turned down cold. And meantime from Ottawa itself emanated the cry "Big contracts for shells are being given to the United States firms. Why can't Canada get more of them?" Now people are asking if this cry was started simply to cover up the fact that all orders were being parcelled out among the favored few who were receiving from $2.90 to $5.15 for machining a dollar's worth of shell. Anyway, just as soon as the British Munitions Board was assured of sufficient quantities of shells at reasonable prices we find half a billion dollars of contracts being talked of for Canada. Somebody apparently has a lot of explaining to do.

* * *

A despatch from Ottawa says: "The munitions committee, it is intimated here, is averse to awarding any more contracts to the small factories and workshops." We have yet to learn why the little fellow, not the big fellow, originally got the orders.

* * *

The secrecy observed by the Shell Committee in regard to contracts would be amusing were it not tied up with conditions that bring the blush of shame to every Canadian cheek. Prominent manufacturers who wished to tender on shells were not even allowed to see the plans and specifications. A reputable Canadian trade paper that wrote to the department for the plans was not only given a curt refusal but was told that the committee considered it inadvisable that anything should be published concerning them. And at the same time there was right in Montreal a German representative of a United States trade publication, who not only had full plans and specifications of those shells but all information concerning them. Was it the policy of the committee that it mattered not who possessed this information so long as it did not reach manufacturers who might possibly put in tenders?

* * *

The purchase of shell boxes was another of the duties of this now famous shell committee. Naturally you would expect them to follow the same policy in regard to the boxes. And you won't be disappointed. There was the same secrecy, the same spreading out of contracts to cover commercial or political depression, and the same awarding of contracts to the little fellows regardless of their equipment or financial capacity. That one of the largest box factories in Canada received a contract for 25,000 boxes and manufactured on a sub-contract 50,000 boxes more is eloquent evidence of the business acumen exercised in carrying on this branch of the business. That a Montreal firm not in the box making trade was awarded a contract which it sublet to a box manufacturer in the same city is further evidence that if the committee was honest it was incompetent. That a company of low financial standing was able to secure a large contract, even though it had to construct a new plant for the work, would indicate that the government—for this shell committee stood for the government—had poor relations whose exigencies gave it greater concern than the exigencies of the Empire.

* * *

When you recall that this trucking and trafficking was carried on while our Motherland was calling for munitions—while men were dying in the trenches for lack of munitions—you might reasonably conclude that the soldier's prayer was the grafter's profit. In France the other day a man who paid a commission to get a contract was heavily fined and sent to jail for ten years. In Canada a similar offender would probably be given a life sentence in the Senate or at least condemned to an Honorary Colonelcy. Such is the politics of Canada.

* * *

The Purchasing Committee is another of our war institutions that is at present staggering along under a sharp fusilade of criticism. It is an eminently respectable body and, in the opinion of many who have watched its workings closely, is doing its best under the conditions. It is composed of Geo. F. Galt, a wholesale grocer of Winnipeg; A. Laporte, French-Canadian wholesale grocer of Montreal, and Hon. A. E. Kemp, Member of the Dominion Cabinet, without portfolio, Toronto, manufacturer of tinware, and politician. It is said that Mr. Kemp leaves most of the actual work of the Committee to Messrs. Galt and Laporte. But here again that scattering of contracts to cover that same commercial depression creeps in and brings forth the usual criticism. The segregation of tenders thus rendered necessary often practically wipes out competition and the net result is that the big concerns are often neglected while many a sweat shop with a machine hastily stuck in a cellar is working night and day to turn out materials that do not keep the equipment up to the requirements of enlistment. Some of the big concerns are prepared to take this work at actual cost in order to keep their factories running and their staffs together. But the system in vogue does not give them a chance.

* * *

I do not doubt that the story recently published in Men's Wear about contracts let to a real estate dealer is, in the main, correct. It suggests so forcibly the work of the Shell Committee. Surely Mr. Kemp is scarcely justified in asking the publisher to throw his cards on the table at the present stage of the game.

* * *

But the strongest criticism offered is that while the committee award the contracts the general business therewith is in the hands of the officials of the department. Just an instance to show how this works out. One call for tenders for a contract amounting to between $75,000 and $100,000 was issued that left but two clear days for figuring. As it was necessary to get in touch with the mills regarding necessary materials some of the biggest concerns in the country did not attempt to put in a tender.

* * *

Now we all know that department officials are above suspicion. They may have social ambitions and be a bit pressed for ready cash when the monthly bills come in but nobody would ever think of their being in collusion with a tenderer to whom the short notice given other concerns would be an advantage. But government officials have to do what they are told, and, if it should ever occur to a practical politician that these contracts had vote catching qualities it is not hard to imagine just what might happen. The trick of holding back specifications, on occasion, is an old one.

* * *

The recent Washington note to Great Britain contains such expressions as "cannot submit," "must insist" and so on. Suppose, for the sake of argument, the British Government admitted that their procedure was unconstitutional and came back with "Well, what are you going to do about it?" President Wilson, both by his attitude towards Germany and, in a smaller way, towards Mexico, has taught us to expect that even under such impossible circumstances we should have little to fear from the nation which is "too proud to fight."

* * *

"The Germans have got their bloody hands on our flag and are you going to let them tear it down?" Ten minutes of this kind of campaigning at a recent recruiting meeting by Lieut. Forneret, a returned Hamilton officer, stands in pleasing contrast to the inane attempts of a very large number of self-styled orators throughout the province, who seem to be encouraged chiefly by a recollection of what Samson accomplished with the jaw-bone of an ass.

SEARCHLIGHT.

Pro Patria

To Major E. G. M. Cape, the president of E. G. M. Cape and Company, Limited, Montreal, belongs the honour of raising within a very brief period one of the finest batteries of the many enlisted in Canada—the Third Overseas Battery Siege Artillery. The applications have been more numerous than the positions, and many good men have been refused because they did not measure up to the very high standard set by Major Cape, who is in command. The battery includes draughtsmen, architects, surveyors, engineers and accountants—men who have relinquished good positions in order to "do their bit."

Major Cape is among the foremost Montreal contractors. He is something more than this—he is a trained engineer, who held some excellent positions before starting in business on his own account some ten years ago. He was born in Hamilton, Ont., in 1878, was educated there and at McGill University, obtaining his B.A.Sc. in 1898. For a time he was a lecturer for the University in mechanical engineering. He is a member of the Canadian Society of Civil Engineers, and in 1903-4 acted as the society's librarian. Among the positions held by Major Cape after leaving McGill was that of engineer for the Lethbridge Waterworks and Electric Light Company; assistant engineer for the Lake Superior Power Company, Sault Ste. Marie; and chief engineer during construction of the Canada Car Company's plant.

Major E. G. M. Cape.

About three years ago the company of which he is president was incorporated. They have erected some of the finest buildings—especially industrial plants—in Montreal and the surrounding district. Among these may be mentioned Canadian Vickers Limited, Maisonneuve; Armstrong Whitworth of Canada Limited, Longueuil; and the Northern Electric Limited, Montreal.

Major Cape is a member of several clubs, and is interested in yachting, tennis and skiing.

The directors and members of the Montreal Builders' Exchange have decided to entertain Major Cape to dinner before leaving for the front. A committee, of which the president, Mr. John Quinlan, was the convenor, have decided on Thursday, November 18, as the date for the dinner.

Among the latest list of casualties appears the name of Major Arthur Eugene Dubuc, of Montreal, second in command of the Twenty-second Battalion. Major Dubuc was, prior to joining the forces, resident engineer in Montreal for the public works department of the Federal Government. Mr. J. H. Dubuc, a brother, is an engineer in the Montreal public works department.

Letters to the Editor

The Editor, Vancouver, B.C., Oct. 29
Contract Record:

Your article of the 13th of October on "Constructional Operations in the Winter Season" affords interesting reading to those engaged in building on this Coast. Our winter season is so mild that building operations are scarcely delayed by the cold, the degree of which very seldom falls as low as zero, and never remains there. Twenty or twenty-five degrees of frost is severe weather here, and the wooden forms into which concrete is poured seem to afford a sufficient protection; neither last winter nor the one preceding gave us more than a very few days of clear, cold weather. Nevertheless, the tendency is to avoid constructional work during December, January and February—possibly the force of habit contracted in the East. The real impediment is continuously heavy rain which saturates everything, and when followed suddenly by sharp frost before the water has had time to drain off, to some extent unprotected work is likely to suffer. The advance made in the conduct of building operations on the Coast during the past few years is considerable, and work upon any scale of importance suffers very little delay from climatic causes. Wooden buildings are far more likely to suffer injury than the more substantial classes—frames erected during the wet season swell with absorbed moisture, which when enclosed has no chance of drying out until the summer; studs and joists are then apt to shrink consumedly, to the detriment of plaster and of doors, windows, finish and floors. In short, it is rain, not cold, that interferes with our work and is most difficult to contend with. I fear we can add nothing to the fund of information concerning the progress of building operations during severe climatic conditions. What we seem to require is a tarpaulin of Brobdingnagian proportions.

Yours truly,
R. M. Fripp,
President B. C. Institute of Architects.

The Editor, Montreal, November 8th.
Contract Record:—

I have read with interest, an article contributed to your periodical by Mr. W. J. Haire and published by you in your issue of November 3rd.

The title of this article, "The Corrosion of Metal Plaster," attracted me, inasmuch as I have been vitally interested in this business for the past twenty-five years, having sold the first sheet metal lath that was ever manufactured in this country.

I note the instances quoted by Mr. Haire, and believe that he is absolutely correct in all his arguments and contentions. He cites instances where lathing has been in an advanced stage of progressive corrosion, and I might state that the reason of this progressive corrosion is that proper steps were not taken by the manufacturers to forestall initial corrosion. It is an undisputed fact that when sheet metal is thoroughly embedded in plaster, and the atmospheric conditions provided against, the metal itself will last for an indefinite period. The whole secret of providing against initial corrosion and disintegration is the coating given to the metal in the factory, be that coating of paint or zinc. If the lath is to be painted to provide against this initial corrosion, this paint should be of an elastic property, with a sufficient pigment to provide body in the skin film, and if this paint is elastic it will not chip off, and defeat the object of its application. The paint should be of such a nature that the lath itself should be bent to a circle with a maximum radius of 2 inches without scaling of the paint.

I have seen unpainted metallic lathing applied in buildings in Montreal, becoming so badly corroded within eleven months of its use, that the plastered surface had to be removed and replaced. I have seen painted metallic lathing taken out of the Bell Telephone Company after twenty-two years of use in as good condition as the day it was employed. I have never yet seen a painted or galvanized expanded metal lathing coated after being cut and expanded, removed on account of corrosion in my twenty-five years experience.

I have seen Expanded Metal Lath employed in very heavy moulding and ceiling work, the dead load of which would average 30 lbs. to the square foot, water soaked through tons of water applied in a fire, serving its purpose seven years after this fire, and yet apparently in perfect condition.

To sum up the whole, I would advise all architects and engineers to be very careful and insist that all metal lathing be properly painted with magnetic oxide of iron and linseed oil or galvanized by an approved process.

Respectfully submitted,

W. E. Ramsay.

Mainly Constructional

East and West—From Coast to Coast

The Canada Cement Company are said to have received an eight-million dollar shell order.

The cost of repairing the last Panama Canal slide is estimated in the neighborhood of half a million dollars.

A local aeroplane factory has been started up in Vancouver. This industry has the support of a large number of local citizens.

The Canadian Fairbanks-Morse Company, Limited, have been awarded a contract for munition supplies amounting to some five million dollars.

The Canadian Northern Railway Company is reported to have received a shell contract amounting to approximately one million dollars.

Work is about to start at once on two reinforced concrete bridges, 12 and 10 feet wide respectively, for the municipality of St. Cyprien, Que.

Montreal Tramways Company, which has been engaged in a small way in the manufacture of shells, have closed a further considerable contract.

The Imperial Steel and Wire Company, Collingwood, Ont., are reported to have received an order for trench goods amounting to some five million dollars.

It has been stated that out of one hundred and twenty-six members of the Vancouver Branch of the Canadian Society of Civil Engineers twenty-six have enlisted.

The Munitions Committee has decreed that the price of steel for ammunition to be made in Canada shall not exceed three and a half cents a pound, including forgings.

The British Columbia Packers' Association, of Vancouver, are about to start work on a $20,000 cannery at Albert Bay, B. C. The association will do all construction work.

The whole north side of the Quebec bridge has now been completed, and it is stated that the cantilever arm on the south side will be finished some time during the early summer of 1916.

The Bell Engine and Thresher Company, Seaforth, Ont., have been awarded another contract for the manufacture of shells—this time for thirty thousand, twice the amount of the first contract.

The last of the new shell orders have been placed by the Shell Committee, to the amount of eighty million dollars, in Canada. To date orders amounting to nearly $160,000,000 have been placed in the Dominion.

Mr. A. R. Clucas, who has been on the engineering staff of the city of Vancouver for some time, has been appointed acting city engineer, replacing city engineer West, who recently enlisted for active service.

The Toronto Board of Control have awarded the contract for the Incinerator Building on Don Roadway to Webb & Thomas. Building to be three storeys, of steel, stone, terra-cotta and brick construction.

Mr. J. E. Harrison, Building Inspector, Saskatoon, announces that it is his intention to leave Saskatoon for the coast in the near future, although he has not yet tendered his resignation to the Commissioners.

Mr. S. V. Cox, a member of the engineering staff of the British Columbia Electric Railway, has enlisted for overseas service with the Canadian mounted Rifles. Mr. Cox had been with the B. C. E. R. for three years.

The Appellate Court has awarded C. P. Meredith the sum of $479, being architect's fees due to him in connection with the reconstruction of a store and loft on Albert Street, Ottawa, the property of Mrs. Agnes McFarlane.

Mr. Hugh Walkem, resident engineer for the C. P. R. at Nelson, B. C., has been transferred to the Division Engineer's staff at Vancouver. Mr. H. C. Barber, who was formerly in charge of the tunneling operations at Rogers Pass, succeeds Mr. Walkem at Nelson.

Mr. R. F. Hayward, chief engineer and manager of the Western Canada Power Company, recently addressed the Vancouver Branch of the Canadian Society of Civil Engineers on the Mexican Light and Power Company's plant, illustrating his lecture with lantern slides.

John Logan, barrister, of Sarnia, has served notice on the City Council of that city that legal action will be taken to prevent any more money being spent on the new waterworks at Edward Point until a proper by-law has been submitted to the tax-payers for their approval.

Following the example of the directors of the Dominion Bridge Company, the board of the Montreal Ammunition Company, of which Mr. H. H. Vaughan is president, have decided to contribute two per cent. of their receipts on munition orders to the Canadian Patriotic Fund.

The City Council has offered to bear the expense of a banquet to be held on January 10th for the delegates of the Bricklayers, Masons, and Operative Plasterers' Union who are attending their annual international convention, which opens on January 10th in the Labor Temple.

The building permits issued by the city of Quebec during the month of October amounted to $200,825. This is an increase of nearly one hundred thousand dollars over the amount of the permits issued for the corresponding month of last year, when the figure reached was $108,530.

The new reservoir on Tenth Avenue, New Westminster, was formally placed in commission on November 1. The new reservoir has a storage capacity of 4,200,000, and the total reservoir capacity of the city is now 8,900,000—said to be enough to supply the present population for seven days.

The Clayburn Brick Company have sufficient orders on hand in their fire brick department to keep forty employees busy for the next three or four months. The company are turning out sixty thousand bricks daily, and in addition are supplying pipe for the Greater Vancouver sewerage system.

It is reported that the Toronto-Hamilton Highway Commission are considering the advisability of diverting the highway from the Lake Shore Road between Long Branch and the Humber and following the line of Queen Street East. The Mimico Board of Trade are naturally disposed to oppose this plan.

The Sarnia Metal Products Company have almost completed the installation of the new machine for the manufacture of parts of shrapnel shells, a large order for which they received from the Government recently. They expect to start work on this order in a few days, and they will employ day and night shifts.

Winnipeg Metal Company, Limited, is the name of a newly-incorporated company, who will carry on business as manufacturers and dealers in sheet metal products of all kinds. The incorporators include J. Kovensky, Max Baransky, and Carl Cook—all of Winnipeg. The capital stock of the company is twenty thousand dollars.

It is announced that the Canadian office of the United States Corporation have withdrawn all quotations on steel for delivery in Canada, and that they will accept no more orders for the time being. The demand for steel for the manufacture of munitions has been so tremendous that the company's output has been exhausted.

Sir Lomer Gouin, Premier of the Province of Quebec, Hon. W. G. Mitchell, Provincial Treasurer, and Hon. Mr. Tessier, Minister of Roads, accompanied by Mr. C. E. Therrien, M.L.A.; Mr. F. N. McCrea, M.P., Mayor Mackinnon and a number of councillors and members of the Board of Trade, inspected the Sherbrooke-Stanstead highway recently.

Guy R. Turner, a native of Andover, N. B., who at the time the war broke out was engaged as an engineer on the St. John Valley Railway construction at Fredericton, N. B., has been given a commission in the Royal Canadian Engineers of the First Canadian Division in Flanders as a reward for gallant conduct on the field. Not long since Mr. Turner was promoted to the rank of Sergeant-Major, and afterwards recived a wound in the back of the neck, from which, however, he recovered quickly. Mr. Turner enlisted at Fredericton with the 12th Battalion on the outbreak of war. He was mentioned in despatches several months ago.

It is understood that the Nova Scotia Steel & Coal Company have been awarded a contract for shells estimated at from fifteen to twenty million dollars. The contract is for large shells, 8-in. and 9.2-in. The company will manufacture the steel and make the rough forgings. It is said that when the company have completed arrangements to manufacture they will deliver from 4,000 to 8,000 8-in., and from 2,000 to 3,000 9.2-in. shells each week. The contract will keep them busy for a year at least. The Nova Scotia Steel Company intend to discontinue the manufacture of the smaller shells, this business being turned over to other companies.

Another main road in the Province of Quebec has been officially opened by Sir Lomer Gouin. This is the Sherbrooke-Derby Line highway, giving Sherbrooke a connection with the adjoining States and the White Mountains. It is 33 miles long, of gravel, with a bituminous surface for six miles. The road starts at Sherbrooke, and runs through Lennoxville, Waterville, Massawippi, Cassville and Stanstead to Rock Island, Que., just across the line from Derby Line, Vt., from which place there is a good road to Newport, Vt., and beyond. Sir Lomer Gouin stated that the Government had spent nearly $14,000,000, of which about $5,000,000 were spent in 1914 and about $4,000,000 this year.

The City Council of Toronto has refused to sanction the awarding of a contract for an incinerator chimney to the Canadian Custodis Company because Conrad Worms, President of the company, was born in Germany. The Canadian Custodis Company is owned in the United States, and Mr. Greeley, the company's representative, stated that Mr. Worms had applied for naturalization there. Controller Foster said that did not help matters. Controller Thompson said that Toronto had sent thousands, and would send thousands more, to fight the Germans, and that while this was going on they could not give city work to firms controlled by Germans. Mr. Greeley cited the amount of work which his firm had carried out for the Allies, but Controller Spence retorted that they would have done just as much for Germany had she been able to receive the goods. Fresh tenders will be called for the chimney column.

The Coaticook Water Company have just completed an improvement to their water system, and are ready to start their new pump. For the last few years Coaticook has suffered in the summer time from a shortage of water, and the company had to look for new sources of supply. At one time it was their intention to use the water of the Coaticook River, but before they would have been allowed to do this they would have had to install expensive plant for sterilizing the water, and so they made arrangements with the Grand Trunk Railway to take water from certain springs on their property near their station. They have conducted the water from these springs to a reservoir recently built on Cutting Street, near the Coaticook River, and some three feet below the river-bed. This reservoir will hold 100,000 gallons. A pumping station has been installed with a pressure of 110 lbs., which will force the water through the mains in the town and even up to the large reservoir in the Township of Barford, which holds a quarter of a million gallons. A new main has been laid from the Barford line around to middle town, crossing the river near St. Jean Baptiste Street. If, therefore, anything should go wrong with one of the main lines where it crosses the river, another would be available. These improvements have cost the company some twelve thousand dollars.

Concrete Construction Stood the Test

(Continued from page 1187)

spread of the fire on this floor, the partitions being of a non-fireproof material.

The Edison fire resulted in many adverse reports as to the fireproof qualities of concrete, it being alleged that concrete buildings will not withstand the fire test. In this instance, however, it may be pointed out that while the fourth floor of the nine storey building was burned out completely, the remaining portion of the building was left intact. The fire was in fact confined to the floor on which it started.

What Is Luck?

YOU often hear it said, "That fellow certainly is lucky." As a rule, the "luck" in his case consists of getting up at six in the morning, living on half of what he earns or less, meeting his appointments, paying his bills, minding his own business, working like Sam Hill —and always keeping an eye on the track ahead. There may be exceptions, but this is the general rule.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Bertie Township, Ont.
The Township Council have decided to reconstruct the sewage system in connection with the Fort Erie Race Track. Work will probably start shortly. Clerk, M. S. Pound, Ridgeway.

Brussels, Ont.
The Town Council will call for tenders in the spring for laying a macadam pavement on Turnberry Street. Estimated cost, $3,200. Clerk, F. S. Scott.

Colchester South Township, Ont.
The Township Council have decided to have plans prepared for the Munger and Ferris Drains. Clerk, J. H. Madill, Barrow, Ont. ... ...

Dryden, Ont.
The Town Council have engaged B. S. McKenzie, Consulting Engineer, 1002 Union Trust Building, Winnipeg, Man., to report on the construction of a waterworks system. Town Clerk, L. J. Wilde.

London, Ont.
The Utilities Board are considering the construction of a 12-inch watermain on Ridout Street and the installation of a lift pump and piping in connection with the Labatt Well. General Manager, E. V. Buchanan.

Montreal, Que.
The contract for laying asphalt pavement on St. Andre, Panet and St. Lawrence Streets has been awarded to the Sicily Asphaltic Paving Company, Ltd., 60 St. Viateur Street E.

Moore Township, Ont.
The Township Council intend to lay a number of tile drains and to make extensions to others. Clerk, C. C. Watson, Brigden, Ont.

Port Dover, Ont.
The Town Council have appointed Councillors Moon and Wilson a Committee to secure estimates on the construction of a water system. Town Clerk, James Sloan.

Regina, Sask.
The City Commissioners have decided upon the installation of an electrically-driven pumping plant at Boggy Creek, with a capacity of two and a half million gallons per day. This will involve the construction of at least ten miles of transmission line, and is estimated to cost $12,000. City Clerk, George Beach.

Toronto, Ont.
The following work has been recommended by Commissioner of Works R. C. Harris:—sewers, $3,660; asphalt paving, $19,000; asphaltic concrete paving, $7,697; brick block paving, $38,554; concrete paving, $4,016.

Vancouver, B.C.
The City Council and the Vancouver Sewage Commission are considering a project for the construction of the Stanley Park Causeway and a trunk sewer across the coal harbor together. City Engineer, F. L. Fellowes. Approximate cost, $40,000.

Wheatley, Ont.
The Town Council intend to lay cement sidewalks on Forter Street. Work will start shortly.

CONTRACTS AWARDED

Gosfield North Township, Ont.
Contracts for the construction of tile drains have been let by the Township Council to Greenway & Campbell, at $1,280, A. Boon, $850, and to E. McCoombs, $1,205.

Toronto, Ont.
The Board of Control have awarded contracts for sewer construction to the Asphaltic Concrete Company, 74 King Street E.; to Routly & Summers, 47 Sparkhill Avenue, and to Longo & Gentile, 663 Markham Street.

Contracts have been let by the Board of Control to Works Commissioner R. C. Harris for the construction of asphalt paving on Condor and Empress Streets, at $4,143, to A. J. Penberthy, 292 Booth Avenue, for sidewalks on Annette Street, and to W. Bushell, 2007 Davenport Road, for sidewalks on Weston Rd.

Railroads, Bridges and Wharves

Mitchell, Ont.
The Town Council are considering the erection of a bridge or the reconstruction of the present one, which is too light. Clerk, William Ryan.

Quebec Province
The Canadian Pacific Railway Company, Montreal, have been authorized to construct a spur and siding for J. Brodie & Son, at mileage 121.8, Laurentian Sub-division.

The Board of Railroad Commissioners have authorized the Canadian Pacific Railway Company, Montreal, to construct an industrial spur for the Canadian Explosives Limited, Lot 182, Parish of St. Jeanne de l'Isle Perrot, Vaudreuil County.

St. Cyprien, Que.
The Municipal Council are about to build two reinforced concrete bridges by day labor.

Toronto, Ont.
The Grand Trunk Railway Company have been authorized to construct a siding into the premises of the Toronto Furniture Company, Limited, Mowat Avenue.

CONTRACTS AWARDED

Cape Breton, N.S.
The Dominion Department of Railways and Canals, Ottawa, have let a contract to Jones, Girouard & Company, Limited, Plaza Building, Rideau Street, Ottawa, for the construction of eight bridges on the main line of the Intercolonial Railway, Sydney Sub-division.

Quebec, Que.
The Canadian Northern Quebec Railway Company, Toronto, Ont., have let the contract for grading in connection with the construction of a line between Lorette and Stoneham to Joseph Gosselin, 96 St. George Street, Levis.

Public Buildings, Churches and Schools

Bathurst, N.B.
The Congregation of Bathurst Presbyterian Church are considering the disposal of their present building and the erection of a new one. Pastor, W. W. Matthews.

Hampstead, N.B.
Tenders will be received until November 27th by T. W. Machum, Jerusalem, Queen's County, on the erection of a school for the Trustees of School District No. 5, Parish of Hampstead. Plans, etc., with Mr. Machum.

Lindsay, Ont.
The Board of Governors of the Ross Memorial Hospital, Kent Street, contemplate the installation of an elevator in the Hospital. Secretary, J. P. McNeillie.

Long Branch, Ont.
Tenders will be received until November 20th for all trades except brickwork required in the erection of a school for the trustees of School Section District No. 12, Etobicoke Township. Approximate cost, $20,000. Architects, W. Smith, 380 Jane Street, Toronto, and P. R. Wright, Baby Point Crescent, Toronto.

Montreal, Que.
The Protestant Board of School Commissioners, Belmont Street, have purchased a site at Ontario and Dufresne Streets for the erection of a school.

CONTRACTS AWARDED

Calgary, Alta.
The Department of Public Works, Ottawa, have let the contract for the installation of customs parcel post fittings to the Riverside Lumber Company, Riverside, Calgary.

Cartierville, Que.
The sub-contract for floor and wall flooring in connection with the Roman Catholic Church in course of erection on Main Street has been awarded to the Montreal Terra Cotta Company, Limited, 23 Board of Trade Building, Montreal.

Fort William, Ont.
The contract for the installation of examining warehouse fittings has been awarded by the Department of Public Works, Ottawa, to the Berlin Interior

Hardwood Company, 72 Wilmot Street, Berlin, Ont.

Halifax, N.S.
In connection with the Acadian School, now in course of erection on Albemarle Street for the Halifax School Board, 81 Sackville Street, the contract for plumbing has been let to Michael Day, 31 Compton Avenue.

Jonquieres, Que.
The Dominion Government Department of Public Works have let the contract for the installation of post office fittings to R. A. Sproule, Beechwood Avenue, Ottawa.

Manitoulin Island, Ont.
The general contract for the erection of a school and residence has been let by the Department of Indian Affairs, Ottawa, to Neil McMartin, Manitowaning, Ont., at $3,765.

Midway, B.C.
Work has been started on the erection of a school for the Department of Public Works, Victoria. The general contract has been let to McDonald Bros., Grand Forks, B.C. Frame construction.

Moncton, N.B.
The contract for the installation of Post Office fittings has been let by the Department of Public Works, Ottawa, to P. N. Leblanc, Bacon Street, Moncton.

Montreal, Que.
In connection with the school being built at Letourneux and Beaubien Streets for the School Commissioners of St. Francois Solano, the contract for furring and partitions has been let to the Montreal Terra Cotta Company, Limited, 23 Board of Trade Building.

The contract for electrical work at the school in course of erection for the Roman Catholic School Board, Ahuntsic, has been awarded to the National Electric Company, 1387 St. Lawrence Blvd.

In connection with the school in course of erection on Hochelaga Street, the contract for plumbing has been let to Thomas O'Connell, 183 Ottawa Street, and the cut stone work to Morrison Quarry Company, 204 St. James Street.

The contract for the supply of McClary stoves for the school now being built on Hamilton Street has been let by the Protestant Board of School Commissioners to Ogilvie Bros., 441 Bleury Street.

Montreal North, Que.
Work has been started on the erection of the Town Hall. The contract for cut stone and masonry has been let to the general contractor, J. A. Charette, 142 St. Ferdinand Street. Tenders are being received for brick work, roofing, plastering, painting, heating, plumbing, electrical work and interior fittings.

Sussex, N. B.
In connection with the construction of the drill hall at Main Street and Magnolia Avenue, the contract for plumbing and heating has been awarded to Thorne & Myers, Sussex, N.B.

Toronto, Ont.
In connection with the chapel which is being built on West Lodge Avenue for the Monastry of Our Lady of Charity of Refuge, the masonry contract has been let to Wickett Bros., 35 Deer Park Crescent. Brick construction, stone trim. Approximate cost, $30,000.

Business Buildings and Industrial Plants

Alert Bay, B.C.
The British Columbia Packers Association, 517 Granville Street, Vancouver, will do all work in connection with the proposed cannery.

Arden, Ont.
Samuel Alexander intends to rebuild his barn in the spring. Material purchased.

Banff, Alta.
R. G. Brett has decided to rebuild his business block on Banff Avenue in the spring. Approximate cost, $20,000.

Brantford, Ont.
The Royal Bank of Canada, 137 Colborne Street, have leased premises at Dalhousie and Market Streets, owned by W. T. James, 52 Marlboro Street. They propose to construct a new stone front and to install banking fixtures, at an approximate cost of $10,000. Work may start in the spring.

Gananoque, Ont.
W. J. Gibson is considering the erection of a garage on King Street and is receiving prices on brick and steel work.

Dungannon, Ont.
John McNabb proposes to erect an evaporator to replace that recently destroyed by fire. Work will start in the spring. Estimated cost, $5,000.

Guelph, Ont.
The knitting mills on Cambridge Street willl be rebuilt either by the owners, J. W. Lyon & Syndicate, Telephone Building, or by the Insurance Company.

Halifax, N.S.
Plans have been drawn for a factory to be erected for Brandram, Henderson, Limited, Kempt Road. Reinforced concrete construction, concrete foundation, asbestos roofing. Estimated cost, $3,000. Company will purchase machinery for the manufacture of bullets.

Leaskdale, Ont.
Lewis Collins intends to rebuild his barn in the spring. Contracts will be let to local men.

Lions Head, Ont.
The Lions Head Flour Milling Company are considering the rebuilding of their mill.

London, Ont.
The Middlesex Mills, Limited, have decided not to erect a building, but have rented premises and will install machinery.

Montreal, Que.
William C. Ball, 3101 Verville Street, has commenced the erection of two stores and five flats, estimated to cost $6,000. All work will be done by owner.

Work has been started by L. P. Forest, 204 St. James Street, on the erection of four stores and flats at Sherbrooke and Oxford Streets. Brick construction, felt and gravel roofing. Estimated cost, $12,000.

North Bruce Township, Ont.
Cushman Smith, The Elbow, Underwood, is considering the erection of fireproof barns to replace those destroyed by fire. Estimated cost, $3,000.

Ottawa, Ont.
J. R. Booth, Booth Street, has commenced alterations and repairs to his pulp house, estimated to cost $20,000.

Pasadena, Ont.
Bruce Hawes, Kintore P. O., is considering the erection of a store to replace that recently destroyed by fire. Estimated cost, $4,000.

Port Dover, Ont.
The Port Dover Canning Company contemplate the erection of a new factory, at an approximate cost of $10,000. Manager, W. Carson.

Quebec, Que.
C. E. Morressette, Limited, 208 Latourelle Street, have commenced the erection of a residence and warehouse, estimated to cost $5,000. Brick and frame construction, concrete foundation, felt and gravel roofing.

Simcoe, Ont.
Edgar Norris, 22 Main Street, contemplates the erection of a bakery and store at Main and Colborne Streets. Work will start in the spring. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $5,000.

Sleeman, Ont.
A. J. Hunter intends to rebuild his barn in the spring, at an approximate cost of $3,500. Frame construction, concrete foundation, cement and steel roofing.

South Maitland, N.S.
The Atlantic Rubber Company intend to rebuild their store and residences, and will call for tenders in the spring. Estimated cost, $5,000.

St. John, N.B.
Work has been started on the erection of stables for the Sisters of Charity, Cliff Street. Day labor is employed, under the supervision of John Flodd, Duke Street.

St. Lambert, Que.
T. C. Kirby, 128 Bleury Street, Montreal, will call for tenders shortly on grading, ballasting, fencing, erection of a double deck grand stand, single stage bleacher and club house required in the construction of an automobile race track for the Canadian Speedway Company, Limited.

Toronto, Ont.
C. Hough, 16 Atlas Avenue, is receiving tenders for heating and plumbing required in the erection of a store and residence at Broadview and Browning Avenues.

The Imperial Oil Company, 311 Dominion Bank Building, have extended the time for receiving tenders on the erection of an office building at Church and Court Streets until November 22nd.

Valleyfield, Que.
The Castings Company of Canada, Limited, 79 Yonge Street, Montreal, are building a forge and foundry building.

Yarmouth, N.S.
J. M. Trefry is building an addition to his garage on Central Street. Reinforced

concrete and cobble stone construction, fireproof roofing.

CONTRACTS AWARDED

Aylmer, Ont.
The general contract for alterations to the club house of the Ottawa Golf Club has been let to A. J. Tomlinson, 92 Florence Street, Ottawa.

Berlin, Ont.
Work has been started on the erection of a factory for Armbrust & Inrig. The general, masonry and plastering contracts have been awarded to Casper Braun, King Street, and the carpentry and roofing to Henry Dunker, care General Delivery. Approximate cost, $11,000.

Cobourg, Ont.
The general contract for the erection of a garage on South King Street for Sparling & Reeson has been let to Jex, Martin & Company, Division Street. Approximate cost, $11,000.

Colborne, Ont.
A. W. Teal has commenced the erection of a barn and stables for W. G. Morrow. Corrugated steel construction.

Hamilton, Ont.
The Acme Stamping Tool Works, Sydney Street, have let the general, masonry, carpentry, steel and roofing contracts for the erection of an addition to their premises to R. E. Jones, 220 Maple Avenue. Brick construction, felt and gravel roofing. Estimated cost, $3,000.

London, Ont.
Work is about to start on the re-roofing of the factory of the London Printing & Lithographing Company, Carling Street. The contract has been let to Hyatt Bros., Egerton Street. Approximate cost, $4,000.

Mitchell, Ont.
The general contract for the erection of a creamery has been let by Dempsey & Holmes, Stratford, Ont., to John Avery, Mitchell. White brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,800.

Montreal, Que.
The D. H. Hogg Company, Regd., 160 Craig Street W., have let the general contract for alterations to the warehouse at 152 Craig Street W. to the Deakin Construction Company, Limited, 37 Major Street. Approximate cost, $5,000.

In connection with the garage being built for William Clark, 622 Sydenham Avenue, the contract for electrical work has been awarded to E. A. Gregory, 1594 Cadieux Street.

Murray Bay, Que.
Work has been started on repairs to the Manoir Richelieu. The contract for concrete work has been awarded to Church, Ross & Company, Limited, 40 Hospital Street, Montreal.

Ottawa, Ont.
Work has been started on the erection of an ice plant on Somerset Street for the Ottawa Dairy Company, Cooper Street. The contract for stairs and architectural iron work has been awarded to Fred A. McKay, 14 St. George Street, Montreal.

The Sherwood Estate, Sparks Street, have let the contract for fire escapes, stairs and ornamental iron work at the theatre in course of erection at Sparks and Bank Streets to Fred A. McKay, 14 St. George Street, Montreal.

A contract has been let to the Campbell Iron & Steel Works, Limited, Carling Avenue, for the supply of door fenders, etc., for the ice plant in course of erection on Somerset Street for the Ottawa Dairy Company, Cooper Street.

Peterborough, Ont.
The contract for electrical work in connection with the alterations to the premises of the Y. M. C. A., 475 George St., has been awarded to Alexander & Miller, 438 George Street, and the plumbing and heating to George Brenton, 99 Hunter Street.

Regina, Sask.
Construction is well under way on the warehouse building on Broad Street for the Robert Simpson Company, Queen and Yonge Streets, Toronto. The general contractors are Wells Bros., Monadnock Building, Chicago. Reinforced concrete construction. Approximate cost, $450,000.

St. Catharines, Ont.
In connection with the business block which is being built on James Street for J. Balsam, 29 James Street, the contract for painting has been awarded to Leach & Jones, 46 James Street. Other contracts not yet let.

In connection with the moving picture theatre being built on James Street by J. & J. Sullivan, Church Street, the contract for wainscoating and art marble work has been awarded to Art Marble & Floors, 320 Dupont Street, Toronto.

Toronto, Ont.
Work is progressing on the erection of a club house for the Danforth Club, Limited, 350 Danforth Avenue. General contractor, H. Lambert, care of the club. Brick construction, tar and gravel roofing. Approximate cost, $5,000.

In connection with the Don Railway Incinerator, the Board of Control have let the general contract for the erection of the incinerator building to Webb & Thomas, 448 Summerhill Avenue, at $84,500. New tenders will be called for the erection of the chimney.

J. A. McKenzie, Architect, Lumsden Building, has let the contract for carpentry in connection with the stores and apartments being built at St. Clair Avenue and Dufferin Street to Hendren Bros., 1 Palmerston Gardens. Lumber and trim will be purchased from the Canada Lumber Company, Limited, Weston.

The Citizens Home Construction Company, Limited, 2261 Yonge Street, have let the contract for floors in connection with the store and apartment building at Yonge and Erskine Streets to Art Marble & Floors, 320 Dupont St.

Trail, B.C.
J. W. Thompson, Trail, has commenced the erection of an addition to the hotel for McDermott & Claughton.

Residences

Anderdon Township, Ont.
Work has been started by Walter Coyle, Amherstburg, Ont., on the erection of a residence, estimated to cost $3,500. Brick construction, shingle roofing.

Hamilton, Ont.
Plans have been drawn for a residence to built on Fairholt Avenue S. by Sparks & McKay, 9 Fairholt Road. Brick construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

Ingersoll, Ont.
Plans are being prepared for three residences to be erected on King Street W. for John Stadelbuer. The contract for labor and material will be let privately. Approximate cost, $4,500. Frame construction, concrete foundation, shingle roofing.

London, Ont.
J. F. Orme, 175 St. James Street, is about to prepare plans for several residences to be erected on Hydro Street. Approximate cost, $10,000.

Montreal, Que.
John Pratt, 2699 Park Avenue, is building six flats on Lanoraie Street, estimated to cost $6,000. All work by owner.

Work by day labor has been started on the erection of six flats on Belgrave Street for Joseph Dalley, 10 May Avenue, Verdun. Brick construction, concrete foundation, composition paper, felt and gravel roofing. Estimated cost, $8,000.

Millen Freres, 1038 Gouin Boulevard, have commenced the erection of two residences on Peloquin Avenue, estimated to cost $3,000. Brick construction, felt and gravel roofing.

J. E. Belanger, 1225 Cote des Neiges Street, has commenced the erection of a residence on Decarie Boulevard. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Work has been started by George E. Blackwell, 4184 St. Catherine Street, on the erection of two flats on Marlowe Street, estimated to cost $7,000. Smaller trades may be let.

Amedee Poirier, 126 Cote St. Paul Road, has commenced the erection of three flats on Le Caron Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

Ottawa, Ont.
T. J. Somerville, 28 Waverley Street, is considering the erection of a residence on Frank Street. Double brick veneer construction, stone foundation, shingle roofing. Estimated cost, $4,500.

Menich Davis, 85 Union Street, has prepared plans for a residence to be erected on Creighton Street at an approximate cost of $4,000. Double brick veneer construction, stone foundation, felt and gravel roofing.

Plans have been drawn by I. Villeneuve, 164 Bayswater Avenue, for two residences to be built on Hinton Street. Work will start soon. Brick construction, concrete foundation, shingle roofing. Approximate cost, $4,600.

Thomas Holman, 2 Oxford Street, will start work shortly on the erection of a residence on Hinton Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

A. E. Toms, 155 Sunnyside Avenue, has prepared plans for a residence to be erected on Brighton Street. Estimated cost, $5,600.

Quebec, Que.
Quotations on all material required in the erection of a residence on Lafrance Street are being received by U. Trudel, 480 St. Francois Street.

St. Marys, Ont.
Work has been started by T. Odette, East Ward, on the erection of a residence estimated to cost $3,000. Frame and white brick construction, shingle roofing.

Toronto, Ont.
A. O. Scott, 568 St. Clarens Avenue, has commenced the erection of a residence on Indian Grove. Tenders are being received for plumbing and heating. Estimated cost, $3,500.

Thomas Holmes, 10 Wells Hill Avenue, is building a residence on Hillbrow Avenue, York Township. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $8,000.

W. Coultis, Clatoria Apartments, Parliament Street, is building three residences on Morley Avenue, estimated to cost $4,000. Brick construction, shingle, felt and gravel roofing.

G. H. Wallee, 236 Kingswood Road, is building a residence estimated to cost $3,000. Brick construction, shingle roofing.

T. J. Maybee, 1980 Dufferin Street, is receiving tenders for heating and plumbing required at the residence which he is building on Sellers Avenue.

S. Fremes, 430 Palmerston Avenue, has had plans prepared for a residence to be erected at Ward's Island, Lot 30-31. Frame construction, shingle roofing. Estimated cost, $3,000.

Work has been started by G. F. McConnell, 167 Yonge Street, on the erection of apartments at Ontario and Prospect Streets. Brick construction, tar and gravel roofing. Approximate cost, $25,000.

Tenders are being received by R. G. Hammill, 140 Victoria Street, on painting and wiring required at the pair of residences in course of erection at 129 McRoberts Street. Particulars on job.

Work has been started by H. Lefneski, 423 Roxton Road, on the erection of a residence at 13 Thornburn Avenue. Smaller trades will be let. Brick construction. Estimated cost, $4,500.

J. W. Clare, 68 Ascot Avenue, has commenced the erection of a residence on Dufferin Street, estimated to cost $3,400. Smaller trades will be let. Brick construction.

Work has been started by A. F. Foster, 960 St. Clair Avenue, on the erection of a residence on Rushton Road, York Township. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $3,000.

M. H. Maton, 1723 Dufferin Street, is building a duplex residence at 14 Ravensden Street, estimated to cost $6,000. Brich construction, tar and gravel roofing. Smaller trades will be let.

Waterford, Ont.
Work has been started by Charles Van Dusen on the erestion of a residence. White brick construction, shingle roofing. Approximate cost, $3,000.

Windsor, Ont.
Plans have been prepared by R. S. Hill, 26 Windsor Avenue, for a residence to be built on Ouelette Avenue, at an approximate cost of $5,000. Brick veneer construction, concrete foundation, shingle roofing.

Work has been started by D. M. Eagle, Erie Apartments, Erie Street, on the erection of a residence on Pellissier St. Frame construction, stone foundation, shingle roofing. Approximate cost, $3,200.

CONTRACTS AWARDED

Brantford, Ont.
The general contract for the erection of a residence at 44 Nelson Street for George White has been let to Chipman & Millman, 79 Northumberland Street. Bartonville pressed brick construction, stone and concrete foundation, shingle roofing. Approximate cost, $3,500.

Ford City, Ont.
The general contractor for the residence which is buing built on the River Front for Fred Merrill, 120 Bruce Ave., Windsor, is William Hedrick, 6 Glengarry Avenue, Windsor. The heating contract has been let to Windsor Hardware Company, 71 Sandwich Street, Windsor. Estimated cost, $5,000.

Hamilton, Ont.
Plans have been drawn for three residences to be erected on Roxboro Street for J. A. McCutcheon, 15 Fairleigh Avenue S. The general, masonry, carpentry and roofing contracts have been awarded to E. Hamilton, 1306 King St. E., and the electrical work to F. Thornton, 174 Balmoral Avenue. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,600.

The following contracts have been let for the erection of a residence on St. Cair Avenue for J. M. Roderick, 19 Holton Avenue S.:—general and masonry, Isbester Bros., Stewart Apartments, Jackson Street E.; carpentry and roofing, J. Vickers, 258 Rosslyn Street; plastering, Hill Bros., 307 Emerald St. N.; painting, Frank Thompson, King Street E.; electrical work, D. Dalgleish, 91 Prospect Street. Estimated cost, $3,500.

A. Stewart, 615 Main Street E., has let the general, masonry, carpentry and roofing contracts for the erection of a residence on Leinster Avenue to Ellison & Jones, 37 Senator Avenue, the plastering contract to J. Manyon, 97 Barnsdale Street N., the painting to Boyd & Sons, 741 Barton Street E., and heating and plumbing to H. Barnes, 23 Fife Street. Estimated cost, $3,500.

Montreal, Que.
D. Peloquin has commenced the erection of two residences on Northcliffe Street for Joseph Paradis, 262 Prud'homme Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

The contract for roofing, heating, plumbing and electrical work at the residence being built for A. Allard, 445 Sixth Avenue, has been let to E. Robert, 93 Vitre Street.

Ottawa, Ont.
In connection with the residence being built on Electric Street by Herbert Cotter, 80 Vaughan Street, the contract for heating and plumbing has been let to A. Digeur, 231 Water Street, and the electrical ork to E. Lecompte, 362 St. Patrick Street.

Work has been started on the erection of a residence for O. B. Shortly, 197 Clemow Avenue. The general contract has been let to Cuthbertson & Clarke, Hawthorne Avenue, and the masonry and brick work to James Patterson, 33 Fulton Avenue. Approximate cost, $10,000.

The contract for heating and plumbing at the residence in course of erection on Powell Street for L. L. Cooke, 359 Somerset Street, has been let to J. T. Blyth, Frank Street.

Quebec, Que.
W. Brochu, 87 Claire Fontaine Street, has commenced the erection of a residence on Aberdeen Street and has let the contract for masonry to P. Tardif, 260 Napoleon Street. Owner is receiving quotations on all materials required. Approximate cost, $7,000.

Work has been started on the erection of a residence on 11th Street, Limoilou, for E. Cauchon, 56 Taschereau Avenue. The general and carpentry contracts have been let to E. Bouchard, 185 Crown Street. Brick and frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

The general and masonry contracts for the erection of a residence on Lafrance Street for O. A. Beriault, 108 Cartier Avenue, have been awarded to Ratte & Frenette, 86 Cremazie Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $13,000.

Louis Careau, 127 Scott Street, has commenced the erection of a residence on Lockwell Street, and has let the contract for masonry and plastering to E. Cote, 358 Richelieu Street.

The contract for roofing at the residence which is being built by W. Vaillancourt, Canardiere Road, has been awarded to G. Lajeunesse, 721 St. Valier Street, the plastering to A. Marcoux, 40 Massue Street, and electrical work to J. Vaillancourt, 141 Fleurie Street.

Lavoie & Frere, 56 Jeanne d'Arc St., have let the contract for roofing, heating, plumbing and electrical work in connection with the residence in course of erection on Cartier Avenue to P. Paradis, 238 d'Aguillon Street. Owners will do plastering and painting.

Work has been started in the erection of a residence on Seventh Street, Limoilou, for G. Langlais, 164 Third Street. The general and masonry contracts have been let to J. B. Verret & Son, 184 Third Avenue, Limoilou. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $5,000.

Toronto, Ont.
The general contract for the erection of a pair of residences at Glencairn and Heather Streets for W. H. Hunter, 50 Chicora Avenue, has been awarded to George Davenport, 51 Helena Avenue. Brick construction. Approximate cost, $6,000.

The masonry contract for the erection of a residence on Astley Avenue has been let by Craig & Madill, architects, Manning Chambers, to Gordon Bros., 1 Delisle Avenue, and the carpentry to W. F. Bell, 5 Brookmount Road. Brick construction, shingle roofing. Estimated cost, $5,000.

In connection with the erection of a pair of residences at Queen Street and Neville Park Boulevard for C. P. Munro, 15 Toronto Street, the masonry contract has been let to E. J. C. Sewell, 204 Waverley Road, and the carpentry to William Davies, 3 Scarboro Road. Other trades not yet awarded. Estimated cost, $4,000.

Verdun, Que.

F. Valiquette, 1225 Evelyn Street, has commenced the erection of five flats for A. Cuerrier, 395 Willibrords Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,500.

Windsor, Ont.

The general contract for the erection of a residence for Matthew Dowd, 70 Wyandotte Street, has been awarded to Thomas Robbins, 47 Bridge Avenue. Brick veneer construction,* concrete foundation, shingle roofing. Approximate cost, $4,500.

William Hedrick, 6 Glengarry Avenue, has commenced the erection of a residence for John Hubner, 188 Dougal St. Brick construction, concrete foundation, shingle roofing. Estimated cost, $6,500.

Power Plants, Electricity and Telephones

Forest, Ont.

The Town Council are considering the installation of a hydro electric lighting and power system. Clerk, R. Karr.

Granton, Ont.

A by-law has been carried authorizing the Town Council to enter into a power contract with the Hydro Electric Commission. The installation of the system is estimated to cost $5,000. Clerk, W. D. Stanley.

London, Ont.

The Utilities Commission propose to install a telephone system to connect the main offices with all water and electric sub-stations. General Manager, E. V. Buchanan.

Otterville, Ont.

Work will start at once on the installation of a hydro electric system, estimated to cost $2,150. Material will be furnished by the Hydro Commission.

Southampton, Ont.

The Town Council are about to secure estimates on the installation of a hydro electric system and to submit the matter to the ratepayers. Clerk, J. C. Eckford.

Woodroffe, Ont.

C. C. Gould, electrical contractor, Woodroffe, Ottawa, Ont., desires to receive prices and catalogues with reference to electrical fittings.

Miscellaneous

Brantford, Ont.

The City Council have decided to repair the sluiceway dam at an approximate cost of $4,660. Clerk, H. F. Leonard.

Leamington, Ont.

The Town Council have decided to instal two 110 h.p. boilers and to erect a boiler house. Chairman of the Water Committee, Councillor Swatman.

London, Ont.

The Carbex Brick Company are considering the installation of rotary kilns. Manager, C. Parker.

The purchase of machinery for the manufacture of shells and other munitions is being considered by the Spramotor Company, King Street.

Marieville, Que.

Prices, catalogues and other information with regard to the following supplies are being received by Joseph Remillard, contractor:—fire apparatus, ventilating registers, metal ceilings, galvanized sheet iron, asbestos board, graphite and iron paint, plumbing fixtures, gravel and paper roofing, slate, asphalt, ventilation grills.

Seaforth, Ont.

The Robert Bell Engine Company have been awarded a contract for the manufacture of shells, and will be in the market for the necessary machinery and material.

Toronto, Ont.

The Board of Control will receive tenders until November 23rd for the construction and erection of Railroad Track Scales at the Main Pumping Station. Plans at office of the Works Department, Room 12, City Hall.

The Board of Control will receive tenders until November 23rd for general supplies during the year, including asphalt, paving blocks, vitrified sewer pipe, stone, castings, sewer brick, cement, sand and gravel. Specifications at Room 12, City Hall.

CONTRACTS AWARDED

Ottawa, Ont.

The Department of Public Works, Ottawa, have let the contract for the supply of a boiler to the Union Foundry & Machine Works, Ltd., 47 Union Street, St. John, N. B.

Spruce Dimension

in any sizes up to 12-in. and in any lengths up to 30-ft.

Also Random lengths in plank and timber.

Spruce treated by the Kyanizing process to preserve it from decay a specialty.

Send for Illustrated Booklet and Prices

BERLIN MILLS COMPANY

Portland, Maine

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Tenders and For Sale Department

WANTED

Clam Steel Bucket, one yard. Specify weight, condition, type and price. Box 262, Contract Record, Toronto. 46-47

Tenders for Railroad Track Scales

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clock noon on **Tuesday, November 23rd, 1915**, for the construction and erection of

Railroad Track Scales at Main Pumping Station

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L .CHURCH, Mayor,
Chairman, Board of Control.

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Tenders for Annual Supplies

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clocn noon on **Tuesday, November 23rd, 1915**, for the following:

Asphalt, Refined
Brass and Bronze Castings
Brass Work for House Services.
Blocks, Vitrified Paving
Blocks, Granite Paving
Blocks, Treated Wood
Brick, Sewer
Bleaching Powder
Castings, Pipe
Castings, Special
Castings, Manholes, etc.
Cement
Gravel
General Supplies
House Numbers.
Hydrants
Iron and Steel
Lead Pipe.
Mineral Dust
Oils
Pipe, Vitrified Sewer
Rubber Valves, etc.
Stone, Crushed Limestone
Stone, Crushed Trap Rock
Stone, Rubble
Sand
Trainmen's Uniforms
Valves, Stop

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall, on or after November 11th. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

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Board of Education

Sealed tenders, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, November 26th, 1915

for

Ventilating Fans, Iron Fence, Ash Hoist, Local Telephones, Art Glass, Bronze Tablets, Steam Fittings, Etc.

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

MILES VOKES,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

46

Board of Education

Sealed tenders, addressed to the Secretary-Treasurer of the Board, will be received until

Tuesday, November 23rd, 1915

for

Automatic Roller Fire Doors at New Central Technical School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash, applying to said tender only. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, **not later than 4 o'clock** on the day named, after which no tender will be received. The lowest or any tender will not be necessarily accepted.

RHYS D. FAIRBAIRN,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

46

A Real Opportunity to Purchase A Going Concern

Foundry and Machinery Establishment. Splendidly located and readily convertible for shell making. Address Box 263, Contract Record, Toronto. 46-48

Late News Items

Hamilton, Ont.

The contract for electrical work at the residence in course of erection at Eastborne and Delaware Streets for W. E. Blanford, 524 Main Street E., has been let to Chadwick Bros., 193 King Street E.

Chadwick Bros. have also been awarded the contract for electrical work at the garage which has been built on Main Street E. for James Wagstaffe, 210 Maple Avenue.

The contract for roofing in connection with the warehouse which is being built on Hughson Street N. for the Lister Estate has been let to M. V. McLean, 314 Hess Street S.

The contract for painting at the theatre erected on King Street E. for J. M. Farewell, care of Strand Theatre, King Street E., has been awarded to J. Ingram, 88 24th Street, Mount Hamilton.

Moncton, N.B.

The Department of Public Works, Ottawa, have let the contract for steel superstructure for the bridge over the Petitcodiac River to the Dominion Bridge Company, Ltd., Lachine, Que., at $125,000.

Montreal West, Que.

Work has been started on the erection of a residence for Rev. A. S. Ross, 153 Percival Avenue. The general contract has been let to W. H. Payne & Company, 62 Westminster Avenue. Brick construction. Approximate cost, $6,000.

A residence is being built on Wolseley Street for C. McClatchie, 100 Easton Avenue, at an approximate cost of $6,000. General contractors, W. H. Payne & Company, 62 Westminster Avenue. Brick construction.

The Montreal West Realty & Contracting Company, 347 Westminster Avenue, are building a residence on Brock Street N. for G. H. Horsfall, 35 Ballantyne Street N. Electrical work will be sub-let. Estimated cost, $6,200.

E. W. Barnes, 191 Wolseley Street, has commenced the erection of a residence on Strathcona Street. Estimated cost, $4,500.

Ottawa, Ont.

In connection with the residence being built by L. McDonald, 88 Fairmont Street, the contract for brick work has been awarded to J. Copeland, Laurel Street, and the heating and plumbing to William Walsh, 694 Cooper Street.

Ste. Anne de Bellevue, Que.

Fire has damaged the Hotel Clarendon to the extent of about $8,000. Owner, P. Rousseau, St. Anne de Bellevue.

Toronto, Ont.

W. G. Hunt, Architect, 17 Queen St. E., has let the general contract for the erection of apartments on Bird Avenue to Scott & Arksey, 70 Hogarth Avenue. Smaller trades will be sub-let. Brick construction. Approximate cost, $5,000.

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CANADIAN WAR LOAN

The applications for the domestic war loan of $50,000,000 indicate that it will be subscribed many times over—evidence of the loyalty and financial reserve force of the Canadian people.

Constructional Operations in Winter

THIS subject of continuing constructional operations during the winter months has been widely discussed in recent issues of The Contract Record, and is evidently receiving careful consideration from contractors and builders all over this continent. Especially, as has been pointed out, Canadian contractors are interested on account of our northern latitude. The United States is, by location, less vitally concerned, and we must not look to them for inspiration.

Can constructional work be carried on during the winter months profitably and successfully? Engineers throughout Canada and the northern United States, where the problem is most pressing, answer in the affirmative. Necessity is the mother of invention, and engineering has made such tremendous strides in anvancement in the recent past that the building trades are confronted with the almost necessity of continuing their work throughout the winter months in order to keep abreast with other trades as well as to meet the competition in their own. A feature well worth consideration, too, is that, with the cold weather, a large influx of enforcably idle men takes place to the larger towns and cities; labour becomes plentiful and cheaper. These conditions will offset, therefore, to a certain extent at least, the greater cost of construction due to increased difficulties in carrying on mechanical operations at low temperature.

Specific cases of work that has had to be carried on during the cold weather have shown that discontinuing operations in winter time is more or less of a habit or a custom rather than a case of necessity, and it has been found that when sufficient protective measures have been introduced good progress has been possible. When the builder becomes convinced of the reasonableness of year-round construction this class of work will doubtless become more and more common.

It is even claimed by some contractors that winter construction is more advantageous and economical in many cases than summer construction, because they have access to sites and locations inaccessible during the summer on account of water, soft ground, or other deterrent conditions. Again, many contracting firms retain most of their skilled mechanics during the slack season, and the client, indirectly, has to pay for this non-productive labour expenditure. Also, plant and capital are idle—a burden not only to the contractor, but also again to the client as well. Further, common labour enforcably idle as a result of suspending operations has to be paid a higher wage during the operating season to provide for the months of idleness, or many of these men become a burden on charity.

Driven by the combined forces of necessity and invention, there is good reason to look forward, therefore, to the time when much more of our Canadian construction work shall be carried along without interruption throughout the entire year. This will do much towards solving our labour problems, will keep plant and capital producing steadily, will relieve the poverty and want of the poorer classes by providing steady work and thereby raising the community's standard of living, will ensure more stable conditions in the building trades, and, finally, will bring our construction operations abreast with the most efficient methods in use in other branches of engineering.

In this connection there appears elsewhere in this issue a report by the Department of Civil Engineering of the University of Illinois, just published, on the compressive strength of concrete with reference to age and temperature. This report shows, for example, that concrete hardened under a temperature of 60 to 70 deg. Centigrade is twice as strong in compressive strength after a period of one week has elapsed as that hardened under a temperature of 32 to 40 deg. Also that the rate of increase in strength of concrete varies inversely as the time and directly as the temperature; further, that alterations of temperature through any considerable range cause a softening and crumbling of the material. This report indicates a line along which care must be exercised by winter contractors in determining the time the forms should remain in place at the existing temperatures to ensure a proper factor of safety.

Right Man for the Work

IT might not be altogether inopportune at the present moment, when Mr. F. P. Jones and his belated shell contracts are so much in the limelight, to point out that few men in Canada are better equipped in training, experience, or natural ability, to undertake the responsible work of executing ammunition contracts. It is true that Mr. Jones is at the present time manager of the Canada Cement Company, and as such may not appeal to the citizen who now hears of him for the first time as a suitable man to be placed in charge of large shell contracts; but it must be remembered that Mr. Jones has been brought up "on" the steel industry, and knows every inch of the ground from personal and painstaking surveys. Following his graduation from the Royal Military College, he began his business career with the Nova Scotia Steel and Coal Company later transferring to the Dominion Iron & Steel Company as their sales manager. His rapid rise to the position of general manager of this latter company was universally accepted as a recognition of his splendid ability and fitness for this work. When, a few years later, the cement merger was looking around for a man big enough for this big job no one wondered that F. P. Jones got the call. Plainly, then, it will be just like going home to Mr. Jones to be engaged again with a phase of the steel industry, and, as on previous occasions, no one who knows his record will have any doubts as to the satisfactory outcome.

A Quantity Surveyor

THIS term is a new one in Canada. Mr. Hugh Watkins, a "quantity surveyor" of London, England, has arrived in Winnipeg, and he and the two assistants he has brought with him have commenced their duties in connection with the new Parliament Buildings. Mr. Watkins will make a careful survey of the quantities of material necessary for the completion of the work, and will publish a printed schedule of quantities to furnish a basis on which tenders for the completion of the structure will be called. The profession of "quantity surveyor" is one which has been in existence in England for forty years, but has not yet been tried in Canada. Mr. Watkins is confident that if the system were adopted here it would meet with the same success that has attended it in England, and would become a standard practice in building contracts throughout the Dominion. When it is desired to erect a building in Canada under the existing system an architect is engaged to prepare the necessary drawings and specifications, which are forwarded to each contractor who has signified his intention of bidding on the work. Each contractor then sets to work to prepare the necessary measurements of materials and labor to enable him to arrive at the amount of his bid. This does not apply to buildings alone. At the present moment a Canadian city is calling tenders for a gravity filtration plant—plans and specifications to be furnished by the contractor.

The prevailing practice in England is to appoint one qualified surveyor to prepare this data, which is called a "bill of quantities," and submit it to each of the contractors concerned, and from that data each contractor prepares his estimate.

It will be seen that in the old method, assuming that twenty contractors were bidding on some work, nineteen of the quantities proved useless and waste labor. Also, it naturally follows that when a contractor knows that there is only one chance in twenty of his labor being rewarded, he cannot afford to make such a careful and accurate estimate, often not as careful as he ought, in his own interests, to make. A further advantage in appointing an independent surveyor is that the bills of quantities become available for the use of the architect and the owner of the building and form the basis on which any extras or deductions can be arrived at.

Gravity Filter Plant for St. Hyacinthe

The City of Hyacinthe, P. Q., is calling for tenders for a mechanical gravity filter plant, the plans and specifications for which have to be furnished by the contractor. The capacity of the plant, to replace the existing one, is to be 3 million Imperial gallons of filtered water every 24 hours, with an ultimate capacity of an additional million gallons, all the concrete structures, buildings, pipings, etc., being such that the addition may be equipped at a future date. The clear water basin is to have a capacity of 150,000 Imperial gallons, while the sedimentation basin is to be preferably arranged in two or more parts, each provided with an overflow at high water mark and arrangements for draining and cleaning. Hose connections under city water pressure will be provided in each section of the basin. The plant will be located within the boundary of the pumping station and power house property owned by the city, and it is in the discretion of contractors to bid upon the reconstruction of the present filter house. Two double suction type centrifugal pumps, (each capable of delivering 4 million Imperial gallons), electrically driven, are to be installed, and the contractor is to connect the suctions of the pumps with the present 20-in. suction pipe now in use. The pumps are to be provided with automatic control to maintain a constant water level in the sedimentation tank. The rate of filtration through the sand beds or filters must not exceed two Imperial gallons per square foot of sand surface per minute. It is also proposed to move the 20-in. discharge main. The suctions of the existing high lift pumps are to be changed, together with the arrangement of the discharge piping from these pumps. The city is asking for the inclusion in the bids of an extra 2 million gallon three stage electrically driven centrifugal pump, capable of being operated either for domestic use or in case of fire, giving a constant water pressure of 70 to 80 pounds per square inch and in case of fire 120 pounds. It is intended to replace the two 100 horse power boilers in use with one 200 horse power boiler of the water tube type. Mr. Hector Cadieux is the city engineer.

Rogers Pass Tunnel Well Advanced

Will be largest on American continent—Double track throughout five-mile length—Some interesting details of the construction features

The new five-mile double-track tunnel of the Canadian Pacific Railway through the Rogers Pass summit of the Rocky Mountains, is now well advanced.

This tunnel, which will probably be the largest on the American continent, is being built to eliminate the present high-level summit and heavy railway grades, and to form part of the extensive plan of the C. P. R. to provide increased facilities for traffic.

It is expected the tunnel will be completed by the end of 1916. During construction the work is notable for the novel methods of tunnelling employed. Intermediate headings are made practicable by driving from each end a pioneer tunnel parallel with, but distant from, the main tunnel, and running crosscuts from the drift to the line of the main tunnel.

The following details of the tunnelling work, timbering, concrete lining, ventilation and permanent track construction, are taken from a current issue of the Engineering News:—

The tunnel will be 26,400 ft. long between portals, on tangent, and will have a grade of 0.95 per cent. throughout. In section it will be 29 ft. wide at rail level, with vertical sides and semicircular roof. The height will be 21½ ft. from base of rail to crown, or 23 ft. above sub-grade. Construction was commenced in September, 1913, and the contract calls for completion within 3½ years, by Dec. 3, 1916. This necessitates rapid and steady progress, and for this purpose a novel method of driving the tunnel was devised by the contractors and approved by the railway company's engineers.

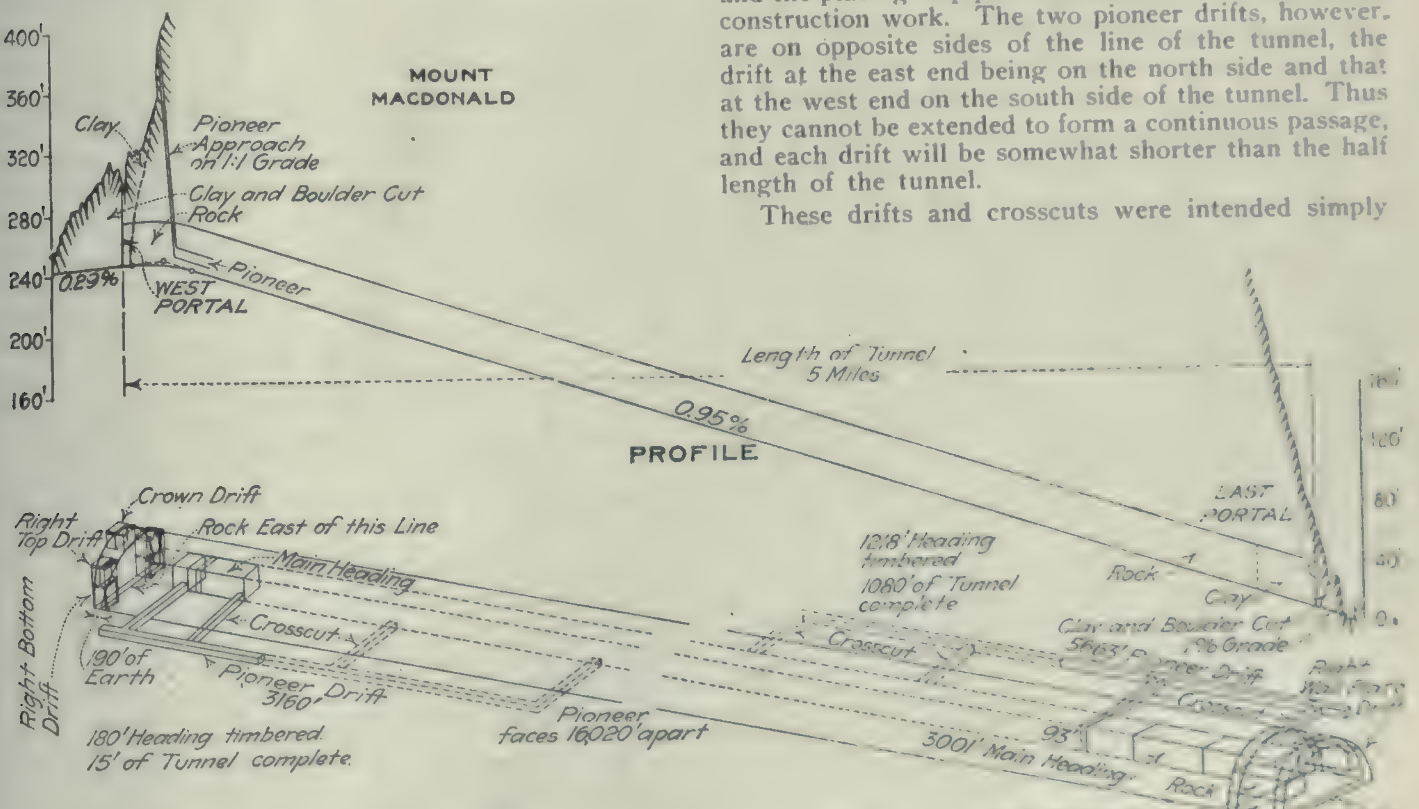


Fig. 1.—Isometric projection—showing the method used in the construction of pioneer drifts and crosscuts.

Two Pioneer Side Tunnels Employed

To drive this long tunnel from the two ends only would have involved a protracted period of construction, and in order to expedite the work it was highly desirable to attack it at various points by means of intermediate headings. Shafts as used for tunnels at moderate depths were out of the question for this great Rocky Mountain tunnel. Nor were there opportunities for the use of adits, or horizontal shafts, such as have been employed in exceptional cases of side-hill tunnels.

The method devised was to drive from each end a pioneer tunnel or drift parallel with the main tunnel, but about 50 ft. distant from it. From these two drifts lateral drifts or crosscuts are driven to the centre line of the tunnel at intervals of 1,400 to 3,000 ft. From each of these points the main tunnel heading is driven, working usually in the upgrade direction. This method gives numerous points of attack on the main tunnel. The drifts serve for the removal of material by the mucking cars, the ventilation of the headings and the placing of pipes and cables clear of the tunnel construction work. The two pioneer drifts, however, are on opposite sides of the line of the tunnel, the drift at the east end being on the north side and that at the west end on the south side of the tunnel. Thus they cannot be extended to form a continuous passage, and each drift will be somewhat shorter than the half length of the tunnel.

These drifts and crosscuts were intended simply to facilitate the work on the tunnel, and their construction is entirely at the contractors' expense. It was not intended to use them permanently, and in fact if loose ground is encountered they may be filled with concrete after the completion of the work. There seems to be a possibility, however, that they may be

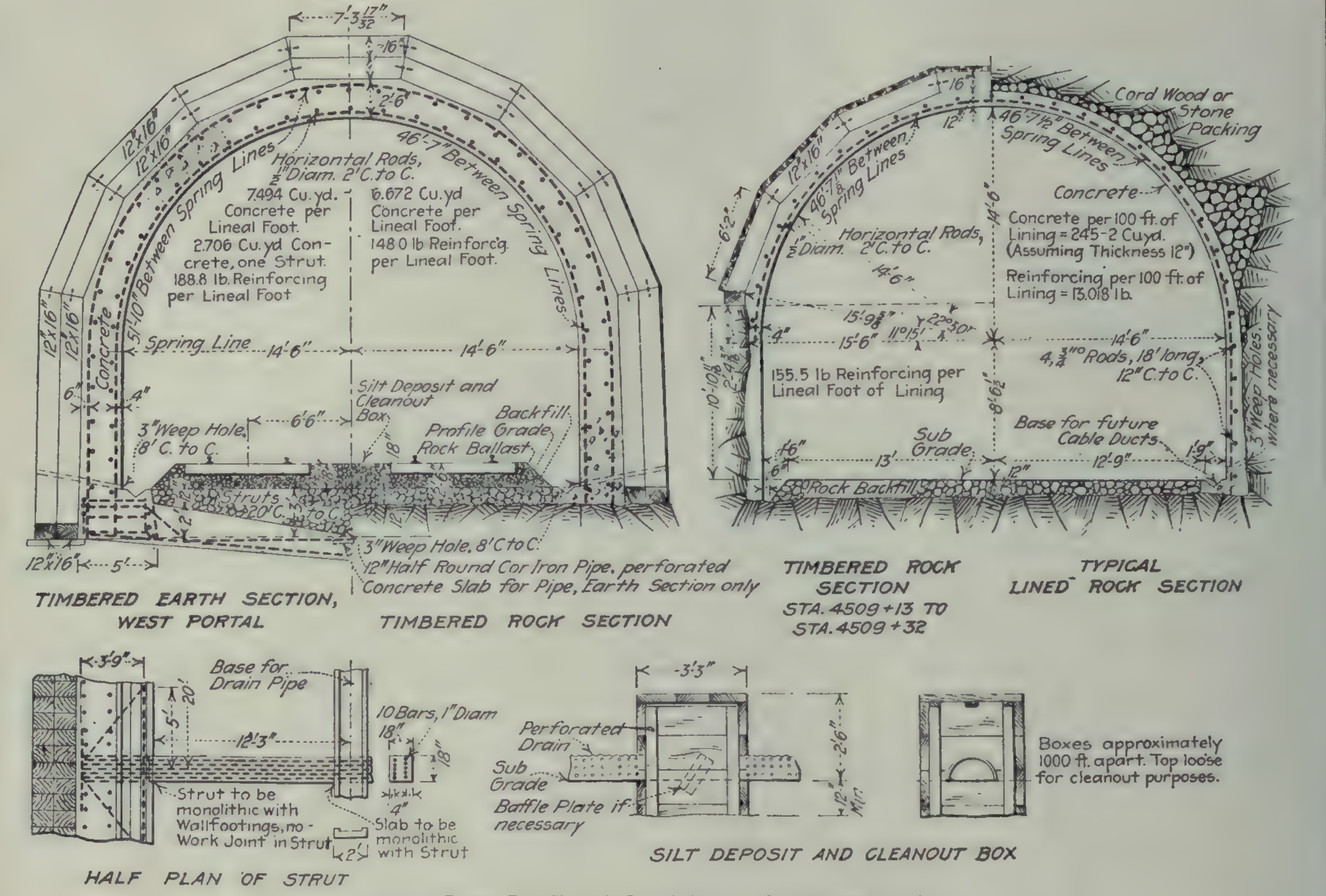

7'-3 17/32"
16"
2'6"
12"x16"
12"x16"
51'-10" Between Spring Lines
Horizontal Rods, 1/2" Diam. 2' C. to C.
46'-7" Between Spring Lines
7.494 Cu. yd. Concrete per Lineal Foot.
2.706 Cu. yd Concrete, one Strut.
188.8 lb. Reinforcing per Lineal Foot
6.672 Cu. yd Concrete per Lineal Foot.
148.0 lb Reinforc'g. per Lineal Foot.
Concrete
Spring Line
14'-6"
14'-6"
6"
4"
Silt Deposit and Cleanout Box
3" Weep Hole, 8' C. to C.
6'6"
Backfill
Profile Grade
Rock Ballast
18"
Struts 20' C. to C.
12"x16"
5'
3" Weep Hole, 8' C to C.
12" Half Round Cor Iron Pipe, perforated
Concrete Slab for Pipe, Earth Section only
TIMBERED EARTH SECTION, WEST PORTAL
TIMBERED ROCK SECTION
16"
12"
12"x16"
46'-7 1/8" Between Spring Lines
46'-7 1/2" Between Spring Lines
Cord Wood or Stone Packing
6'2"
14'-6"
Horizontal Rods, 1/2" Diam. 2' C. to C.
Concrete
Concrete per 100 ft. of Lining = 245-2 Cu yd. (Assuming Thickness 12")
Reinforcing per 100 ft. of Lining = 13.018 lb.
14'6"
15'-9 5/8"
22°30'
11°15'
4"
15'-6"
14'-6"
4, 3/4" Rods, 18' long, 12" C. to C.
10'-10 1/8"
2'-4 3/16"
155.5 lb Reinforcing per Lineal Foot of Lining
8'-6 1/2"
Base for future Cable Ducts
3" Weep Holes, where necessary
Sub Grade
6"
6"
13'
12"
12'-9"
1'9"
Rock Backfill
TIMBERED ROCK SECTION
STA. 4509+13 TO STA. 4509+32
TYPICAL LINED ROCK SECTION
3'9"
Base for Drain Pipe
20'
5'
12'3"
10 Bars, 1" Diam
18"
18"
4"
Strut to be monolithic with Wallfootings, no Work Joint in Strut
2'
Slab to be monolithic with Strut
HALF PLAN OF STRUT
3'3"
Perforated Drain
Sub Grade
Baffle Plate if necessary
2'6"
12" Min.
Boxes approximately 1000 ft. apart. Top loose for cleanout purposes.
SILT DEPOSIT AND CLEANOUT BOX

Fig. 2.—Rogers Pass Tunnel Detailed views of construction work.

utilized in the ventilating system for the finished tunnel, as noted further on.

The nearest approach to a previous use of this system in driving long tunnels was in the construction of the first Simplon Tunnel in Switzerland. A small drift was run on one side parallel with and a little in advance of the main tunnel, and connected with it by lateral drifts. But in this case the main tunnel was for single-track only, and the parallel drift was intended for use temporarily as a part of the ventilating system and eventually to be enlarged to form a second single-track tunnel. Its enlargement for this purpose to meet the traffic requirements of the Simplon route was begun in 1913 and is now under way. The rate of progress and cost of work on the great Canadian tunnel are considered to have amply justified the driving of the auxiliary construction drifts.

The method of construction is shown in the isometric drawing, Fig. 1. The pioneer drifts and crosscuts are of rectangular section, 8 ft. wide and 6 ft. 6 in. high. The main or central heading, also rectangular, is 11 ft. wide and 9 ft. high. Working from each portal, this main drift is being enlarged to the full tunnel section shown in Fig. 2.

The object aimed at by the novel method adopted for the construction has been attained. This is shown by the fact that two steam shovels, one working at each end, have advanced at the rate of 1,636 ft. per month for the last three months. On July 25 the two pioneer tunnels were stopped when they were 5,202 ft. apart. Crosscuts were made to the centre or tunnel headings at these points, and the remaining mile of centre heading will be driven and the drilling for enlargement completed before the mucking shovels reach these last crosscuts.

Up to Aug. 19 there had been driven 10,740 ft. of pioneer heading at the east end and 8,870 ft. at the west end. There were 7,366 ft. of main heading driven at the east end and 8,352 ft. at the west end. On that date the most advanced headings were only 4,677 ft., or 0.89 mi. apart. The shovels on the enlargement of the tunnel to full section have advanced 5,612 ft. at the east end and 4,300 ft. at the west end, leaving 16,488 ft. to be covered. Of the concrete lining at the ends about 1,600 ft. has been completed.

Driving the Drifts and Headings

To save time and excavation the pioneer drifts were started considerably above the grade of the tunnel heading. The drift at the east end starts about 50 ft. above grade and is practically level, so that the first two crosscuts slope down to reach the main heading. From the point where the drift strikes the same elevation as the tunnel it rises with the tunnel grade of 0.95 per cent. and the crosscuts are level. The drift at the west end starts about 130 ft. above grade and descends on a sharp incline of 50 per cent. grade for 230 ft., which brings it to the elevation of the tunnel heading. Beyond this the drift is on the same grade as the heading and the crosscuts are level. At first the muck cars were hauled up this 50 per cent. incline by cables. After the full tunnel section had reached the first crosscut the cars were diverted through this into the tunnel, as described below, thus eliminating the use of this incline.

Drainage of the face of the west pioneer drift, working down grade, is handled by a pump at the face and two intermediate station pumps. It is not expected that much water will be encountered in the rock, but in the loose material at the ends it has been necessary to pack hay behind the timbering of the side-wall drifts to prevent washing in of soil.

The muck from the pioneer drift and the various points on the main heading is hauled in ½-yd. cars through the drift and crosscuts to the nearest crosscut which has been reached by the full tunnel section. Here the cars are diverted to enter the tunnel and dump their contents into the 12-yd. standard-gauge cars which serve the mucking shovels at the face. The shovels are air-operated machines of about 40 tons with 1- and 1½-yd. buckets.

The ½-yd. cars were at first hauled by mules, but narrow-gauge compressed-air locomotives are now used. The larger cars are hauled by 10- and 12-ton compressed-air locomotives working between the face and the sidings for loaded and empty trains. These trains are handled by 40-ton six-wheel steam locomotives between these sidings and the outside dumping places. At the east and west ends the muck is dumped to form the long approach embankments to the tunnel.

Drilling and Power Plant

In driving the pioneer drifts at the east end four Leyner drills are mounted on a bar. These put in about 24 holes 6 ft. deep, 1¼-in. top and 1⅛-in. bottom diameter. Each hole is loaded with from 4 to 8 lb. of 50 per cent. dynamite. Three to six rounds are usually fired per day of 24 hr., three 8-hr. shifts. Similar drills are used in the centre bench, drilling rounds of 26 holes 6 ft. apart, or 225 lin. ft. per round. These sections or "rings" are shot off for muck as required.

The compressed-air plant at each end includes two compressors supplying air at 125-lb. pressure for the drills and shovels and one supplying it at 950-lb. pressure for the locomotives. The latter has a capacity of 750 cu. ft. of free air per minute, while the two others have capacities of 1,000 and 2,000 cu. ft. Each locomotive has storage capacity sufficient for a 1-mi. run with a load, and the 1½-in. high-pressure main is extended into the tunnel, providing air stations about 2,000 ft. apart.

Driving the Portal Headings

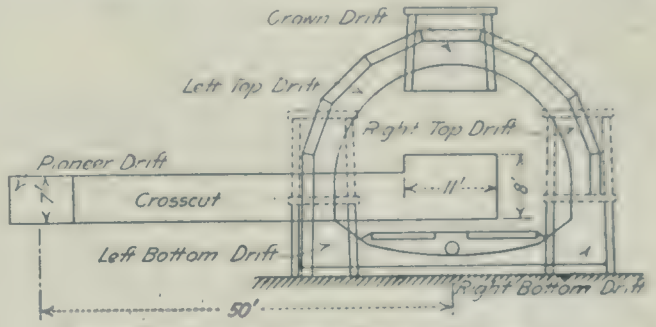
For driving the full tunnel section from the portal in the east end two side drifts, 7 x 8 ft., were driven, with floors about 18 in. below the level of the wall plates for the roof centering. These were connected by a curved crown drift so that the centering could be placed, and the inclosed "core" then removed. The construction is shown in Fig. 2.

For similar work at the west end the two timbered side drifts were at grade and were about 6 ft. wide and 8½ ft. high. Upper-side drifts, 6 x 7 ft., were driven about these, the muck being delivered through the roof timbering of the lower drift into cars standing in that drift. A crown drift 8 ft. wide and 9 ft. high was also driven on the centre line (Fig. 2). The material between the crown and upper-side drifts was then broken through and the timbering placed outside the line of the future concrete lining.

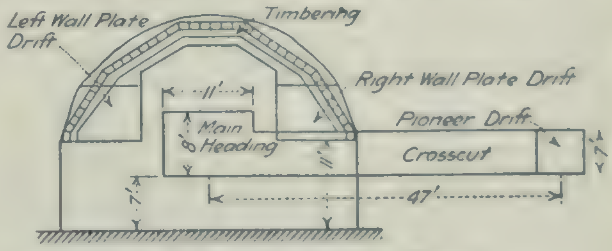
With the exception of several hundred feet of clay and glacial drift at each end, the drifts are in solid rock, which is expected to continue throughout the entire length. It is mainly slate, schist and quartzite. No timbering is required in the rock excavation.

For the end portions, which are in loose material and are timbered, a concrete lining is required. This is 30 in. thick and 483 ft. long at the west end and 27 in. thick and 1,288 ft. long at the east end. In addition, on account of the spalling of the rock, some concrete lining may be required in the solid-rock section at the west end. Typical sections of the tunenl, with its timbering and concrete lining, are shown in Fig. 3. The timbering in the glacial drift consists of a semicircular roof arch supported on 12 x 16-in. posts. The timber sets are usually spaced 18 in. c. to c., but are set close where the material is loose and contains water. The arch has five or seven segments, usually single, but sometimes double.

An interesting feature is that for the lined section in loose material the heavy footings of the side walls are braced by reinforced-concrete struts 20 ft. apart. These are 18 in. wide, 24 in. deep at the ends and 18 in. at the middle. They are formed monolithic with the footings and with the longitudinal concrete slab for the support of the track drain.



Cross-Section of West Portal of Tunnel



Cross-Section of Main Tunnel

Fig. 3.—Cross-sections of the Rogers Pass Tunnel.

The concrete for the tunnel lining is mixed by concrete mixers on the outside and loaded into cars, which are hauled into the mouth of the tunnel by a dinkey. A cable from a hoisting engine hauls the cars up to the work. The concrete is dumped into the forms for the side walls from an elevated track on scaffolding, but is shovelled by hand into the arch form above the level of the scaffolding. Timber forms are being used, as the amount of concrete does not justify steel forms.

For ventilating the working places in the centre bench and main tunnel there is a large blower installed in each pioneer drift. This is set up to draw pure air through the drift and discharge it into the centre bench through a crosscut ahead of the centre-bench drills.

For ventilating the faces of the pioneer drift and advance heading two exhaust fans of the Connersville type, with 12-in. wood-stave pipe, are used, placed usually near a crosscut. From this point the exhaust pipe is carried to within 25 ft. of each face. A gate is provided so that the fan can exhaust from either face as required. Only one of these fans is worked at a time, so that one can be moved while the other is in service. The fan is started at each blast, and the men can return to work in from 15 to 25 min. By opening the 1½-in. air line for the drills the smoke and fumes can be cleared away from the face so that they will be removed by the exhaust.

At the portal of each pioneer drift there has been installed a multivane fan 5 ft. in diameter, which forces air into the drift. This air is diverted into the main tunnel whenever required. For instance, after shooting in the enlargement to full tunnel section the air is turned in at a cross-drift beyond the point of shooting. In this way the smoke and gases are cleared out of the tunnel very rapidly.

The compressed-air pipes, ventilating pipes and telephone lines are laid through the pioneer drifts and crosscuts, so that they are not affected by blasting and do not interfere with the work of the mucking shovels in the full tunnel section. No electric lighting is used. The men carry acetylene lamps and acetylene headlights are applied on the mucking shovels and the locomotives.

Working Force and Staff

The force per 8-hr. shift in the pioneer drift is as follows: Four drillers, 4 drills at each end, 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 to 4 mules and about 40 cars.

The force per 8-hour shift in the advance heading of the main tunnel is as follows: Three drillers, 3 drills at each end, 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 mule, and 60 to 80 cars, according to the length of haul. In addition, there is the following force on each 10-hr. shift to cover the two small drifts in each end: One assistant superintendent, 1 walking boss, 2 blacksmiths, 2 blacksmith helpers, 12 laborers, 10 dump men, 6 teamsters, 14 mules, 1 hoist-man and 7 pipe-fitters, carpenters, mechanics, etc.

The centre bench of the main tunnel is worked in 8-hr. shifts with 7 to 10 drills, 7 to 10 helpers, 5 to 10 muckers, 1 shifter, 1 driver and 1 mule.

The completion of the main tunnel to full section is worked in 10-hr. shifts, with the following force per shift: One driller, 1 helper, 1 to 2 powdermen, 1 engineman and 1 craneman on the mucking shovel, 10 to 12 pit men at the shovel, 1 general foreman, 1 fore man and 12 to 15 laborers for the dump and track work, 2 compressed-air dinkey locomotives with 2 enginemen and 2 brakemen, 1 steam locomotive and 1 engineman, 1 fireman, 1 conductor and 2 car-repair men.

The contractors for the tunnel are Foley Bros., Welch & Stuart, of Winnipeg, and A. C. Dennis is their superintendent. The work is under the direction of John G. Sullivan, Chief Engineer, Canadian Pacific Railway, and W. A. James, Engineer of Construction.

In the finished tunnel the tracks will be spaced 13 ft. centre to centre, and will be laid with 85-lb. rails on wood ties embedded in 18 in. of stone ballast. Beneath the ballast will be 12 in. of rock fill, the floor of the excavation being carried down 12 in. below subgrade. A semicircular drain of corrugated iron will be laid in the rock fill beneath the tracks, the pipe being perforated for the admission of water. In general it will be laid on the rock floor, but in the loose material at the ends the pipe will be laid on a concrete slab of channel section, supported by the concrete slabs between the footings of the side walls (Fig. 3).

The plans for the tunnel project originally contemplated the introduction of electric traction in the tunnel and over a distance of about 25 mi., and no artificial ventilation was then considered necessary. This feature of the project has been abandoned and a ventilating system is to be installed to avoid possible troubles due to smoke and gas in the 5-mi. bore. The definite plans for this system have not been determined, but possibly it may be found practicable and economical to utilize the construction drifts, with their lateral connections to the tunnel, as part of the permanent ventilating system. These drifts, as described in the foregoing, are outside of and parallel with the tunnel, but do not form a continuous passage.

No one can question that the day is near at hand when automobile storage on every third lot will be deemed a necessity; hence the argument in favor of providing the alley for this use is much more powerful than it would at first appear.

The use of the alley space for sewers, water mains, gas mains, ducts and wires for telephone, telegraph, lighting and power services has long meen recognized by engineers.

L'Air Liquide Society, Maisonneuve, Que., are distributing a new catalogue regarding their oxy-acetylene welding and cutting apparatus.

Mr. H. E. Prindle, architect for the new Union Station at Quebec. A description of this work by Mr. Prindle appears on the following pages.

Handsome Station for Quebec City

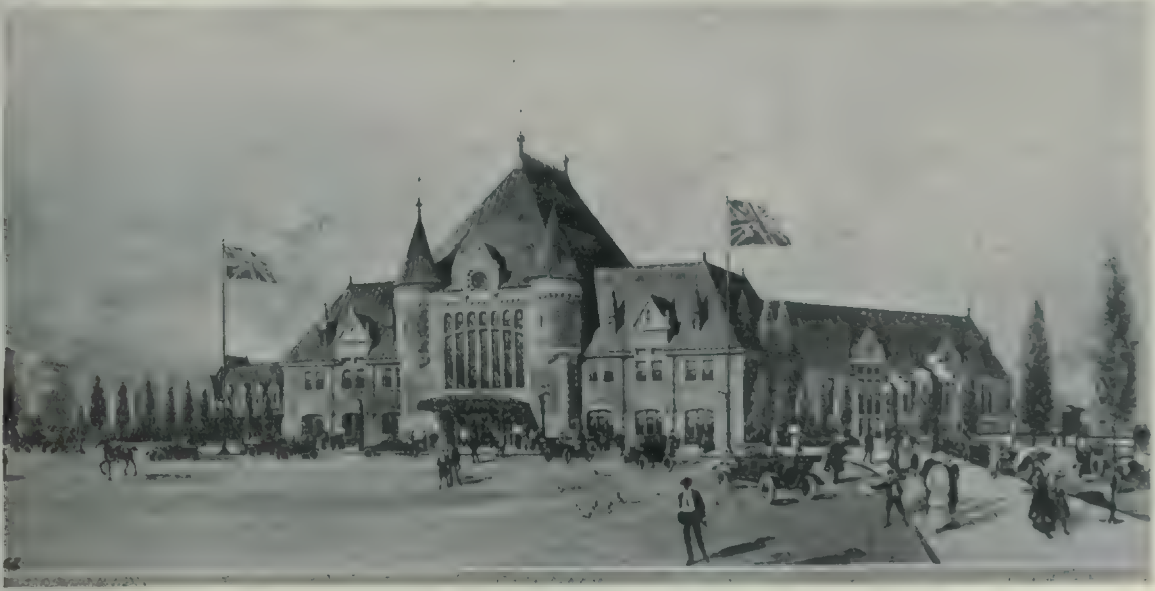
Work well advanced as shown by photos herewith — Will be one of the finest in Eastern Canada—For joint use of C. P. R. and Transcontinental

By H. E. Prindle, Architect

"So the future seemed
To mingle with the past. For a short space
I saw revealed the double threads that bind
This little speck of time we call 'To-day'
To the great cycle of unending life
That has been and that shall be evermore."

"Unexampled for picturesqueness and magnificence of position on this continent, and for the romance of her historic associations, Quebec sits on her impregnable heights, a queen among the cities of the world." —(Charles Marshall).

The history of the city is intimately interwoven with that of old France, and this spirit is admirably expressed in its narrow, winding, ascending streets, its groups of high-pitched roofs, its churches, monuments and people. The mind of the observer contemplating its natural beauties inevitably turns to the old world, with its great monuments of art and architecture, and perhaps more particularly to the Chateaux of Chinon, Loches, Langlais, Chaumont, Chenonceaux, Ambroise, Blois, Chambord and Azeay-le-Rideau which was the moving impulse from which has grown the design of the new Union Station Building. The building is located on the property bounded by St. Paul, Henderson and St. Roche Street, which has been entirely re-arranged, with new tracks, coach storage yard, express yard, freight sheds and freight office building. The station is approached from St. Paul Street by an open paved plaza, approximately 300 ft. x 300 ft. enclosed by broad curving sidewalks reaching the entrances, with a driveway into the express yard. The concourse opens directly into Henderson Street, which leads to the new freight offices. The plaza will be encircled with ornamental lamp standards and the central section flanked by tall steel flag poles. The planting spaces around the plaza and on Henderson Street will be filled with Lombardy poplars and the spaces about the building occupied by harmonious masses of blue spruce and shrubs. The building is L shaped in plan, with the express wing approximately 46 ft. x 150 ft. parallel to St. Paul Street, with power house 46 ft. x 75 ft. with a boiler stack 100 ft. high on the end toward St. Roche Street. The concourse wing on Henderson Street is approximately 65 ft. x 150 ft. and is practically on the diagonal axis of plan.

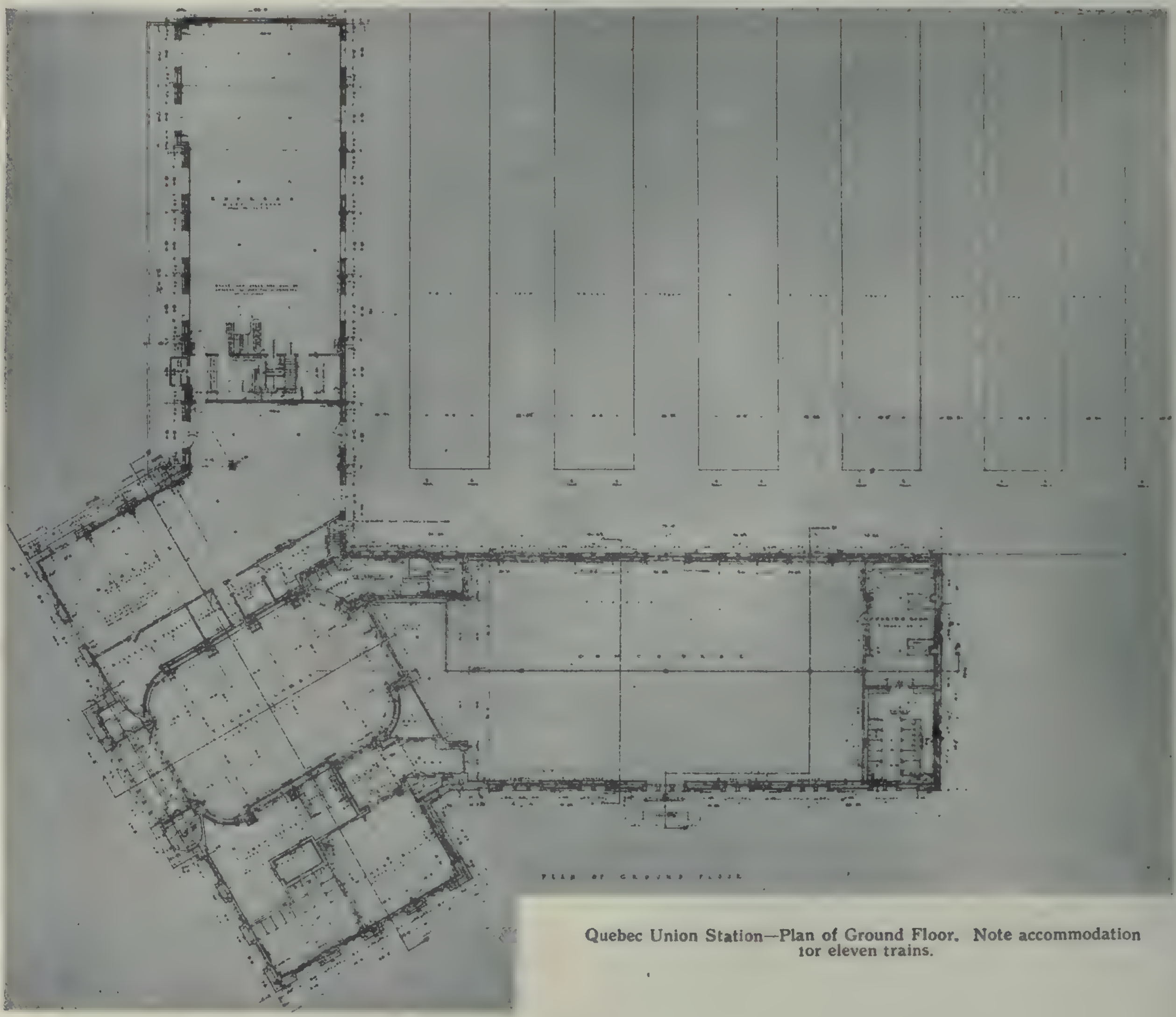


General view of Quebec Union Station when completed.

The roof of the central block rises about 90 ft., the roofs of the wings being roughly 50 ft. high. The exterior walls are faced with a dark wire cut brick, laid in Flemish bond in white mortar with deep raked joints with stone facings and granite base. The roofs are of copper. The main entrance is 25 ft. wide, providing seven door openings, over which is a large window opening lighting the ticket lobby. The outer angles of the central block carry brick and stone tourelles between which, at the roof level, is a large ornamental illuminated clock dial. At the base of the tourelles are carved stone shields bearing the Fleur-de-Lys, Rose, Shamrock, Thistle and Maple Leaf; the pediment over the clock is ornamented with the coat of arms of the city of Quebec.

High up over the entrance, executed in leaded glass, are the armorial bearings of seven men famous in Canadian history, to wit:

Montmagny, Governor of Canada, 1636 to 1647.
De Tracy, Viceroy of Canada, 1665.
Beauharnois, Governor of Canada, 1726 to 1747.
Montcalm, Military Commander in Canada, 1756 to 1759.
General Wolfe, 1726-1759.



Quebec Union Station—Plan of Ground Floor. Note accommodation for eleven trains.

Frontenac, Governor of Canada, 1672.

Talon, First Intendant of New France, 1665 to 1672.

The walls of the entrance vestibule are of brick, with marble base, marble and terrazzo floors and vaulted tile ceiling. On either side of the vestibule are the office staircase and the Transfer Company's office. The ticket lobby is 46 ft. x 65 ft. and 60 ft. high, with a marble floor, the walls being of a light tapestry brick, laid up white mortar with recessed joints. The high pitched ceiling, finished in Mosaic tile, is shaded in color, with inlay patterns. Around the lobby are the ticket offices of the Canadian Pacific Railway and Transcontinental Railway, women's room and lobby, men's room, telegraph and telephone offices, customs offices and parcel rooms and baggage space, with an entrance to baggage room and concourse. At the level of the offices on the floor above is an arcade opening into the upper portion of the ticket lobby. The cornice, balustrades, clocks, wall decoration, etc., are all of faience tile in several colours. The cartouches in the cornice bear armorial devices in color, symbolic of railroads, steamships and hotels. The design of the leaded glass in the ticket lobby ceiling expresses a world-wide development of the Canadian Pacific Railway.

Off the line of traffic in a convenient location is a comfortable women's room finished in oak, the walls being painted in harmonious tones with the toilet room adjoining. The concourse opens into the ticket lobby and Henderson Street, with three wide train gates. It is approximately 65 ft. x 125 ft. x 40 ft. high, the ceiling construction being of concrete, carried on four large semi-elliptical steel trusses. There are large window openings on all sides. The walls are of light colored tapestry brick, laid up with recessed joints in white mortar, through which runs a faience diaper pattern bearing the floral emblems of France, England, Scotland and Ireland. The brackets under the trusses are of faience tile in color, on which the emblems are merged.

The prevailing colour of cornice is an old blue with dolphin and salamander inserts of faience tile. The floor is of marble and terrazzo. Along the two sides of the room are long seats, finished in oak with marble base. The train indicators will be of the most modern type. The smoking room which opens off one end of the concourse is finished in oak, adjoining which is the men's toilet, with standard and pay toilets.

The baggage room contains approximately 2,550 square feet, and express space contains approximately

Centre of Main Entrance—Quebec Union Station.

Quebec Union Station—End view, showing Boiler House.

4,600 square feet. The upper portion of building is occupied by the offices of the Canadian Pacific Railway and the Transcontinental Railway.

The entire building rests upon a system of concrete piles; the floor and part of roof construction is reinforced concrete, sloping surfaces of roof are of gypsum block; the frame throughout is of steel encased in concrete and the walls are masonry. There are 430 concrete pedestal piles, approximately 400 tons of structural steel; 2,000 yards reinforced concrete; 400,000 common brick; 75,000 exterior face brick; 125,000 interior face brick, and 10,000 cubic feet of exterior cut stone. The building will be electrically illuminated, the bulk of the fixtures being indirect. The trainsheds will be low umbrella, or umbrella type.

The station proper will cost approximately $300,000 when completed.

The operation is being carried out entirely under the direction of Mr. D. H. Mapes, engineer of buildings, Canadian Pacific Railway, Windsor Station, Montreal. The general contractors are the Downing-Cook Company of Montreal, and the following is a list of the sub-contractors: Limestone, Chateauvert Quarry Co., Quebec; granite, Argenteuil Granite Co., Montreal; ornamental iron, L. H| Gaudry Co., Quebec; steel, Eastern Canada Steel & Iron Works, Quebec; sheet metal and roofing, McFarlane-Douglas Co., Ltd., Ottawa; piling, McArthur Concrete Pile & Foundation Co., New York, N. Y.; marble, Missisquoi Marble Co., Ltd., Phillipsburg, Que.; plaster, R. D. Clark & Sons Co., Ltd., Montreal; mill work, R. McFarlane & Co., Ltd., Montreal; metal sash, Steel & Radiation, Ltd., Montreal; plumbing and drainage, James Ballantyne, Landry & Chatte, Montreal; exterior brick, Citadel Brick & Paving Co., Quebec; interior brick, Dartnell Ltd., Caledonia Brick, Montreal; tile arches, Guastavino Tile Co., Boston, Mass.; boiler stack, Canadian Custodis Co., Montreal; boiler, Babcock & Wilcox Co., (150 h.p.), Montreal; electric work, L. K. Comstock & Co., Montreal.

Fireproof Mill Building for Quebec

Butterfield & Co. adding to their Rock Island Plant

THE new addition to the Butterfield & Co.'s Canadian plant at Rock Island, Que., presents nothing unusual in the standard type of fireproof mill building, unless it be that it holds the distinction of being the only thoroughly fireproof mill building in the Eastern Townships. The addition consists of two buildings having a total frontage of 310 feet on the main roadway between Rock Island and Beebe, provision being made for a future addition of 175 feet more. The roadway runs alongside of the Tomifobia River and at this spot is so close that the rear of the buildings, which have an average width of 63 feet, is in the water under ordinary high water conditions. For the period of construction the water was lowered by means of the Butterfield Company's dam, so that little difficulty was encountered in placing the foundation.

The main building is three storeys and a basement in height; the other building which contains the hardening and tempering plant and stock rooms, is one storev and basement. The floors are the usual type of reinforced concrete slab and beam construction, furnished with a floor hardener at the time of pouring so that the total thickness of the floor is figured in the strength of the slab. The end of the slab next the exterior walls is carried on the walls, which are of brick, there being no columns in the walls.

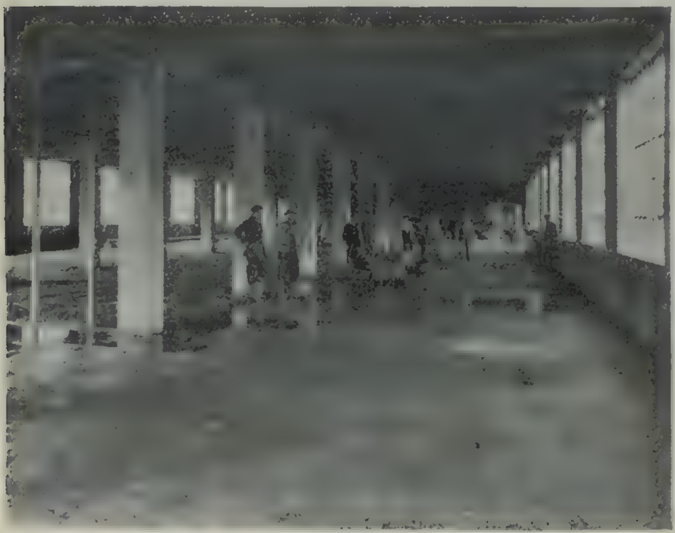
The buildings rest on a bed of gravel which overlays the rock throughout this part of the country, the wall footings being 3 feet wide and the column footings 6 feet square reinforced. The columns, which are 21 inches square in the basement, are placed about 20 feet apart across the building, and 15 feet apart lengthwise. The windows are Fenestra sash and form about 40 per cent. of the exterior wall surface.

The main mill is about 40 feet from the old building and is connected to it by a reinforced concrete covered bridge at the first floor level. The side walls of the bridge, which are 11 feet high and 1 foot thick, form the girders which carry the bridge. The rooi and floor are 3½ and 4½ inches thick respectively.

Butterfield addition well advanced.

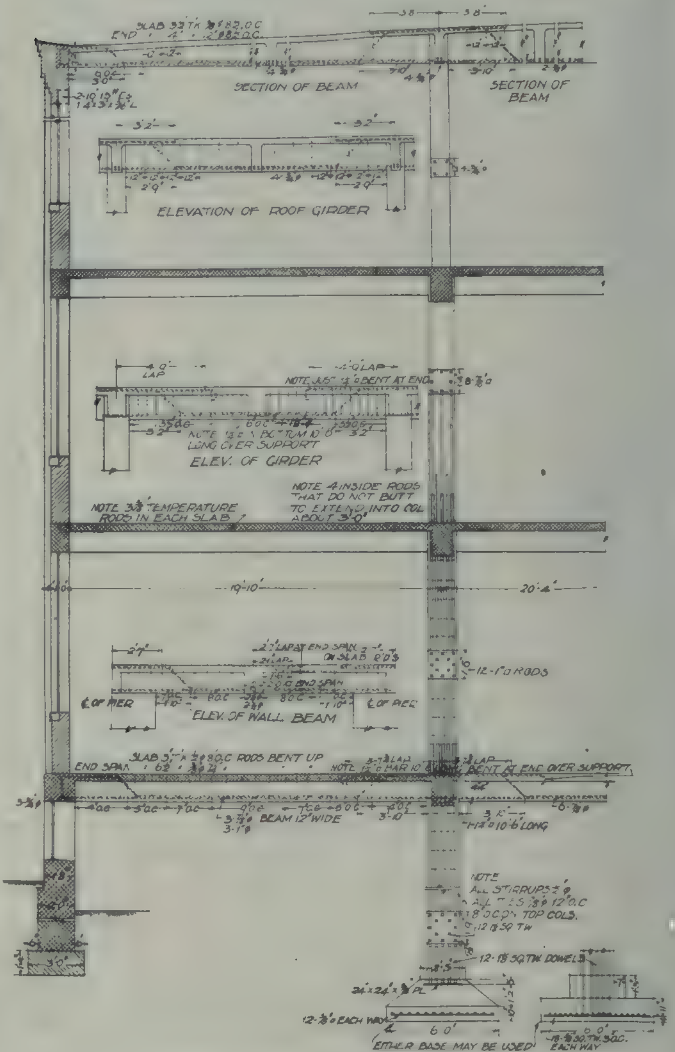
reinforced. The reinforcing throughout both buildings consists of round and square rods bent on the job, about 160 tons of steel being used. The roofing is 5 ply tar and gravel, all flashings and cornice work being copper. The electric wiring is run in conduit throughout, the conduit being fastened underneath the floor slabs, there not being sufficient time to arrange for placing it in the slab, which is undoubtedly the most economical method. The heating is low pressure steam. All interior doors are standard fireproof, hung in angle iron frames, the jambs being protected by plate and angle guards. The plumbing arrangements are excellent, all fixtures being enamelled iron or porcelain set in slate stalls. Drinking fountains have been provided on each floor. The interior stairs are reinforced concrete and are all enclosed in brick.

The concrete, plain and reinforced, was poured by the spouting method, the main tower being 130 feet high. The first 80 feet of spout was hung on a steel boom which enabled the spout to be swung in any direction through an angle of 180 degrees. This worked very well at first, but in time the twisting strain on the tower caused it to deform to such an extent that the swinging of the spout had to be given up. It is the writer's opinion that the spouting method is not economical for long low buildings. It has however worked out very well for high buildings covering a small area of ground.



One of the concrete floors under construction.

The concrete aggregate was broken stone, for although gravel abounded in the neighborhood it was found to contain a large percentage of shaley pebbles which rendered it unfit for use. The stone was all crushed on the job, being found in abundance in the river bed in the form of boulders. The plant layout was somewhat restricted on account of the main road way on one side and the river on the other side of the buildings.



Section of elevation, Butterfield Plant.

The architects were Messrs. Frost & Chamberlain of Worcester, Mass. The general contractors, Loomis Dakin Limited, Sherbrooke, Que.

Mr. Ralph Douglas, railway engineer for the Alberta Government, has just completed an inspection trip along the routes of the Central Canada Railway and the Grande Prairie Branch. He states that the only work that remains to be done on this branch is in the Saddle Mountains.

Mr. Julian C. Smith, Vice-President of the Shawinigan Water and Power Company, on November 18 read a paper before the Canadian Society of Civil Engineers, Montreal, descriptive of the hydraulic development and construction of the plant of the Cedars Rapids Power and Manufacturing Company. Mr. Smith was responsible for the hydraulic portion of the plant, while Mr. R. M. Wilson, who will read a paper on the same plant at the meeting on December 2, designed the electrical section of the work.

Characteristics and Applications of Explosives (Conc.)

By R. M. Smith, B. Sc.

Electric fuse is used for firing under water or for exploding a number of charges at the same time. With this fuse the copper cap is sealed by a plug of melted sulphur and powdered glass. Exploding charges by electricity is considered the most efficient and by far the safest method.

For these detonators various quantities of the fulminate of mercury are employed. The ordinary detonator, whether made for firing by fuse or electricity, contains usually:—

Mercury fulminate	80 parts
Potassium chlorate	20 "

Detonators are graded according to the amount of mercury fulminate in the composition, as follows:—

No. 3 Cap	8.33 grains
No. 4 Cap	10.03 "
No. 5 Cap	12.34 "
No. 6 Cap	15.43 "
No. 7 Cap	23.15 "
No. 8 Cap	30.86 "

No. 6 Cap, known as double strength cap, is the one most used in all work and gives the best results; they are sold at about $1.05 per box. Electric fuse run about 5 cents apiece on the job.

Quarrying

The engineer and quarryman are more concerned with the selection of explosive to get the most efficient results. For rock in highway work, the low freezing dynamites are probably the best adapted. Where a strong smashing action is desired the nitroglycerine grades can be used, and where more of a spreading and heaving action is necessary blasting powder will give the best results.

Mistakes are often made in regard to producing rock for macadam. If the rock is hard and flinty a high explosive breaks it into pieces or spalls, full of flaws, and the additional fracturing in a stone crusher renders it unfit for heavy traffic because it grinds down too quickly. A milder explosive causes fewer small fractures and the life of the macadam is much prolonged.

General rules that should be followed:—

(1) Do not allow cartridges with caps attached to be scattered around.

(2) Dynamite should not be packed in the same box with caps or fuse, and they should never be brought together until ready to use.

(3) Avoid bringing matches or other easily combustible substance near an explosive.

(4) Avoid the use of hard or rigid tools. Copper is the only metal which may be used about explosives.

(5) Use only quantity of explosive necessary for work in hand. Keep main supply well removed from vicinity of work, well protected from fire or shock and from being handled by unauthorized persons.

(6) In transporting nitro-glycerine, guncotton (dry), dynamite and gelatine, it is necessary to have an elastic bed of hay, straw or excelsior to deaden the shock in travelling.

(7) Never prepare a dynamite primer near nitroglycerine compounds, or explosive gelatine.

(8) Before firing, warning should be given to all persons.

(9) In case of misfire, do not make haste to investigate cause. Wait at least twenty minutes; then, when satisfied that no explosion will take place, remove as much of the tamping as is safe, say to within 2 or 3 inches of charge, first having disconnected the wiring if electric battery is being used. Put in new primer with a small charge of high grade explosive, retamp and fire, the small charge setting off charge

Thawing

To thaw dynamite two vessels should be employed, one sitting inside the other; then cartridges are placed in the smaller one. Use warm water in which you can place your hand, not above 125 deg. F. Never use boiling water, and do not set near fire to keep warm. Another method is to put it in a box containing horse manure.

The best way is never to allow it to freeze, but to keep it in a warm room at summer heat, covered up and dark as possible, away from sun's rays.

Any dynamite that is not perfectly pliable has still some frozen parts, and is dangerous to use.

Loading

Black blasting powder, after bore-hole has been cleaned, is placed in bottom and tamped with a wooden rammer. Fuse should reach some distance into charge and be carefully tamped in place; it should not be cut to required length until ready to fire. The entire charge should be well tamped, using dry sand, moist sand, fire clay, etc. Proper tamping very much increases the efficiency of the charge.

Dynamite charges are placed somewhat the same as powder, the first sticks being pressed into bottom of hole, then primer with fuse attached as near centre as possible. The remainder of the charge is added, and finally tamped with clay or sand; ground brick also may be used. Many quarrymen contend that placing the primer on top or bottom gives just as good results. When firing with electric fuse, care should be taken to properly connect lead wires to fuse, but never connect lead wires to battery until ready to fire. To prepare the primer when firing by safety fuse, cut end of fuse squarely across and place in cap, first making sure that fuse is perfectly dry. Be careful that, pushing fuse in cap, no twisting occurs. The fuse should just touch the fulminate or the varnish protecting it. Then with a pair of crimpers (and not with the teeth) fasten the cap on fuse. An opening is then made in the dynamite stick with a wooden plug and fuse placed in this opening. The cap should touch the dynamite on all sides, since any space around it causes a cushion of air and lessens effect of detonation. The fuse is firmly tied in place. If the primer requires to be waterproof, this may be done by using soap, tallow or wax. The string holding fuse in place should be of sufficient length to lower primer to bottom of hole. It should not be let down by fuse.

Mudcapping

When blasting boulders by mudcapping them (also known by several other names), the charge of dynamite is packed closely against the surface on the top or side of the boulder, covered with mud, and exploded. The charge should be placed on the spot which would be struck with a sledge if the boulder were small enough to be broken in that way, and should be packed in a solid mass by slitting the paper cartridge shells and massing them together, taking care not to spread them over the surface of the boulder any more than absolutely necessary. A blasting cap crimped into fuse should be placed in the middle of the charge and the whole covered with six inches of damp clay or sand. This should be pressed firmly over the explosive, care being taken not to cover the outer end of the fuse. If the boulder is deeply embedded in the ground it is best, before blasting, to dig away or loosen some of the earth surrounding it.

If the boulder is cracked or seamy, the charge should be placed in some depression and covered with a quantity of clay or sand, as described before; this gives the explosive greater power.

A test made by the Bureau of Mines, Washington, to determine the effect of drilling and tamping holes in boulders, showed that a 1-inch hole 12 inches deep, with 1 ounce of explosive, had practically same effect as a 1 pound of unconfined explosive laid on the rock. The conclusion is that where time is not the principal object it is more efficient to drill.

However, we can only balance cost of drilling against cost of explosive. Three sticks of dynamite will practically cost the same as a 6-inch hole.

Must Await his Turn

J. BULL
INTERNATIONAL PRESCRIPTIONS ATTENDED TO.
BULL'S
GREAT NAVAL STRANGULATION CURE FOR "FRIGHTFULNESS"
DR. WILSON'S PRESCRIPT FOR NEUTRAL AND BLOCKADE GRIEVANCES (15000 WORDS)
SOAP

Druggist Bull—Just in a minute, Sammy, just as soon as I gives this 'ere gent 'is straffing drops.

(Reproduced by courtesy of the Toronto World)

Stripping

The rock in quarries is generally covered with a layer of earth which it is necessary to remove before blasting or separate from stone after blasting. This stripping will vary with the character of soil, depth of cut necessary, and the distance to which the material has to be moved. In estimating cost this may be considered as ordinary earthwork.

Drilling

This may be done either by hand, with steam, or compressed air. The two first named methods are generally used in Ontario. However, portable air compressors run by gasoline are used extensively in the United States. One with an air cylinder 8 x 10 inches gave 96 cubic feet of free air per minute at 165 revolutions, with 80 or 100 lbs. air pressure. A hoisting attachment for pulling rock from trenches, etc., was also connected on rear of machine. The entire outfit weighed about 8,000 lbs. Three hammer drills were used, each averaging 50 ft. per day. The cost per foot was approximately 14 cents.

In limestone, drilling by hand costs anywhere from 35c. to 45c. per foot. Drilling from steam costs from 20c. to 30c. a foot. In granite these prices are increased 25 to 30 per cent. In limestone three men will probably not drill more than 15 ft. per day. The steam drill averages about 45 ft. per day. In granite and trap rock these are correspondingly decreased 25 to 30 per cent. The estimates given above are for 1¼ inch steel.

Blasting

There are few operations in quarrying where a workman can display a higher degree of skill and effect larger economies than in the proper placing of bore-holes, and in the proper adjustment of his charges to the work to be done. Against the firing of one hole the following may be charged; labour, power (steam or air) where machine drills are used, wear and tear on plant, explosives, and a general loss distributed among many items in the operation of the quarry.

For the most part efficient work in blasting is a matter of experience and good judgment. This cannot be taught in books, but there are general rules which are fundamental, and in proportion as these are understood and appreciated the work of quarrying will be conducted with greater system and economy. Unsystematic efforts are always wasteful and costly, and system implies the recognition of some definite principles according to which the work is laid out and prosecuted:—

(1) The strength and quantity of the explosive should be properly proportioned to the cohesive strength or resistance of rock.

(2) The "burden," the shortest line that can be drawn from the charge in the bore-hole to the outer free face of rock, should bear a proper relation to the strength of the explosive and to the resistance of the rock.

(3) If the working face of rock is so blasted as to leave two or more free faces instead of one for future blasts, the explosive required to overcome the resistance of the rock will be reduced.

(4) A seam or fissure may become important help, if hole is properly located, but the opposite may occur if charge is improperly placed.

(5) Breaking to regular benches and faces is the most economical method; rock can be carefully ob-

served for seams and fissures, admitting of a more intelligent placing of subsequent bore-holes.

(6) Simultaneous firing is more economical in most cases than singly or in series, for the reasons that the adjacent charges assist each other, reducing the amount of explosive required and the total length of holes to be drilled for any given volume of rock.

(7) Careful charging and tamping is absolutely essential. The more compact the charge the more efficient the results.

(8) The object in quarrying is to rupture rock, not to hurl it some distance. Hence only enough explosive should be used to accomplish this. Where rock is thrown a great distance, it is evident that the proper relation did not exist between the charge and the burden, and that too large a charge was used for the length of the line of least resistance.

The amount of explosives required depends upon —(1) kind of explosive used; (2) depth of bore hole; (3) line of least resistance; (4) what stone is being used for.

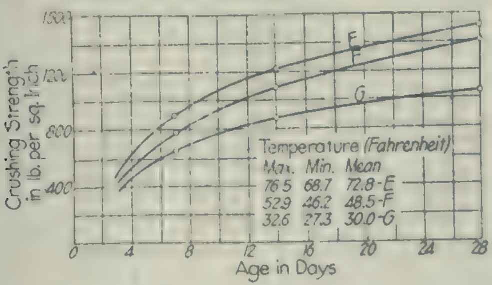
The amount of 40 per cent. dynamite required by a cubic yard of rock excavated varies from the depth of the hole, decreasing as the depth of the hole increases. In open cut work we must use the formula P = 3 d, in which P is equal to the pounds of dynamite required for cubic yard of rock and "d" = depth in ft.

The holes are generally spaced equal to their depth, but after 5 ft. in depth we may use the formula as $=\frac{10}{4}\sqrt{d}$ (s = spacing; d = depth).

Temperature Effect on Concrete Strength

Cold weather retards setting and variations in temp. cause softening and crumbling.

Tests made at the laboratories of the University of Illinois to determine the strength of concrete at early ages under different temperatures, contain much interesting information for the contractor. Three groups of tests were made—group 1, forty-five 6 x 6-in. cylinders; group 2, fifty-one 6-in. cubes, and group 3, sixty 8 x 16-in. cylinders, subjected to various molding and storage temperatures. All test specimens were made with Universal Portland cement, clean, well graded Attica sand, and crushed limestone in the proportions of 1:2:4 by weight, or 1:2.2:3.6 by volume. The materials for each specimen were weighed out separately and then mixed. The temperature of storage room was determined by daily readings of maximum and minimum thermometers. All the specimens while in storage were covered with several layers of moist sacking, which was sprinkled daily.



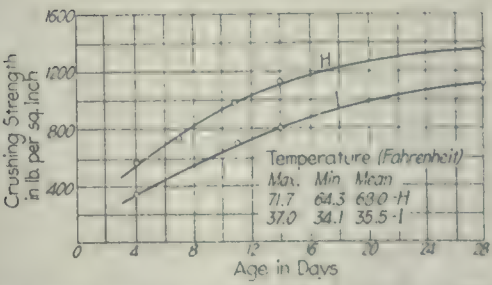


Fig.1 (above) Standardized valves for 6 x 6" cylinders of group 1.
Fig. 2 (below) Standardized valves for 6" cubes of group 2.

The specimens of group 1 were tested, in about 20 hrs. after removal from storage, at the given temperature. The specimens of groups 2 and 3 were brought to the laboratory and tested within 1 hr., with the exception of two specimens which were stored in a room varying in temperature, as mentioned below, and kept in the laboratory at 70 deg. Fahr. for 7 days and 21 days respectively before testing.

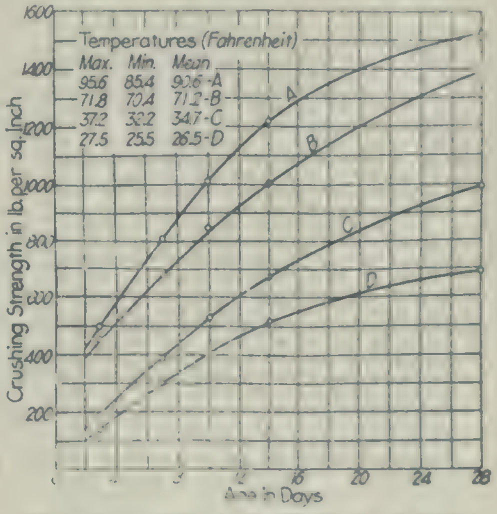


Fig. 3.—Average valve for 8 x 16' cylinders of group 3.

The observed values for the cubes and short cylinders of groups 1 and 2 have been reduced to the equivalent strength which would be obtained for standard cylinders of height equal to twice their diameter by multiplying by 0.73, the ratio determined by the committee on specifications of the American Concrete Institute. These equivalent average values are given in Figs. 1 and 2 for the temperatures indicated on the diagrams.

The specimens of one set were stored in a room where it was known that the temperature would not be uniform. The mean temperature varied from 22 to 35 deg., with an average of 27 deg. for 42 days. All of these specimens tested at 11 days were slightly disintegrated on the surface, and those tested at 28 days were badly disintegrated. Of those reserved to be tested at 42 days only one could be tested, the other two being very badly disintegrated. These two specimens were then kept in the laboratory, as described above, for 7 and 21 days respectively. The 42-day specimen failed at 420 lb. per square inch, while the 49-day specimen (5 x 5 x 6 in.) failed at 1270 lb. per square inch and the 63-day specimen (4 x 5 x 6 in.) at only 400 lb. per square inch. These results indicate that the low temperature retarded the hardening action of the concrete, and that the alterations above and below freezing caused a softening and crumbling of the material.

The average results for the standard 8 x 16-in. cylinders at the mean temperatures shown are given in Fig. 3. It is noteworthy that under a temperature slightly below freezing the concrete gained strength continuously. It is also interesting to note that the curve for a mean temperature of 26.5 deg. is substantially of the same character as that for a mean temperature of 71.2 deg.

The tests are summarized in Figs. 4 and 5. Fig. 4 shows the relation between strength and temperature for the several ages of the tests, and Fig. 5, drawn from the values in Fig. 4, shows in a general way the relation in per cent. between the strength of 28 days for a temperature of 70 deg. and the strength attained at various ages under varying temperatures. These values are sufficiently accurate to furnish suggestive information which may be useful in determining the time when forms may be removed and loads applied.

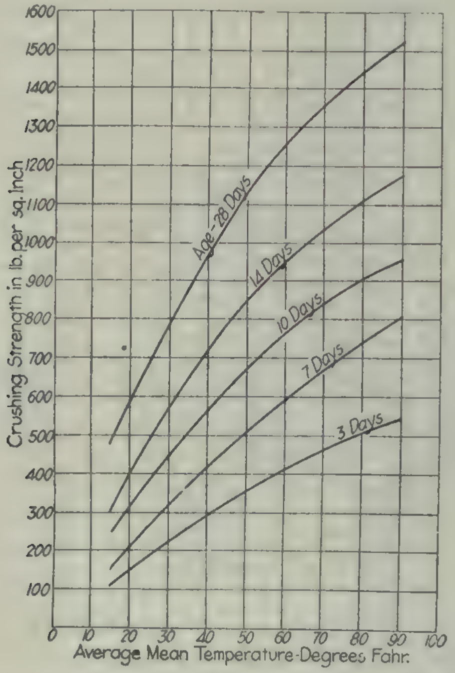


Fig. 4.— Relation of strength to temperature at different ages.

General Conclusions

It is believed the following general conclusions are justifiable:

1. Under uniform temperature conditions, there is an increase of strength with age within the limits of the tests. For any temperature the rate of increase decreases with the age of the specimen, and this rate of increase is less correspondingly at the lower temperature conditions. For the specimens tested, under normal hardening temperature conditions of from 60 to 70 deg. Fahr., the compressive strength of the concrete subjected to a uniform temperature at the ages of 7, 14, and 21 days may be taken as approximately 50, 75 and 90 per cent. of the strength at 28 days, respectively. For lower temperatures the percentage values are less, and for higher temperatures the percentage values are higher. The relation between the percentage values at the ages of 7, 14, 21 and 28 days is nearly the same for temperature conditions from 30 to 70 deg. However, the values for the lower temperatures should be used with caution.

2. Concrete which is maintained at a temperature of from 60 to 70 deg. will, at the age of one week, have practically double the strength of the same material which is kept at a temperature of from 32 to 40 deg.

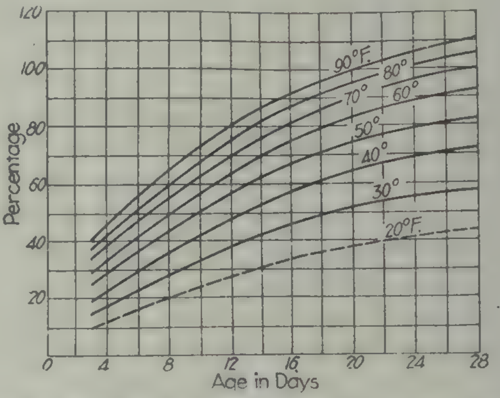


Fig. 5.—Strength percentages for various mean temperatures — Percentages based on strength at 70 deg. for 28 days.

3. Figs. 4 and 5 may be used to determine the representative strength of concrete similar to that used in these tests, for various temperature conditions and for ages up to 28 days. These diagrams may be used with a fair degree of approximation to ascertain the relative strengths which concrete of ordinary practice may be expected to attain at the different temperatures.

Generally in this investigation the specimens were stored under temperatures which were nearly uniform during the whole storage period. In one set the variations in temperature include a number of alterations above and below the freezing point, and the specimens were seriously injured. The results accord with the well known effect of freezing and thawing upon green concrete.

Returning Prosperity already casting its Shadow

	Bu. 1915	Bu. 1914
Wheat inspected to date	108,226,900	51,483,000
In store at country points	34,400,000	20,740,000
In transit not inspected	8,400,000	1,725,000
Allowed for seed, feed and country mills	35,000,000	
Balance in farmers' hands to market	121,203,100	30,127,000
Oats inspected to date	16,000,000	11,142,000
Barley inspected to date	3,400,000	1,929,300

An Unique Pumping Station

The following graphic article is a description of a design of a rather unique pumping station at San Antonio, Texas, U. S. A.

The sinking of the rings for the pump pit was accomplished by alternately removing the earth within the ring, allowing the section to lower of its dead weight, and adding another section to the caisson. In the beginning, the cast iron shoe was set up and levelled and made to a true circle, and upon it the forms for the first section were set and braced, ready for concreting. These forms consisted of eighteen sections of inner and outer rings, the full height of the ring section, and were built of 2-inch plank segments sheathed with 1-inch D & M flooring. The segments were joined together at the ends by bolts, and were aligned and braced with 4 x 4 timbers spaced about two feet around the circle and bolted through the wall. Concrete was placed from a central hoist tower by chuting and was allowed to set for two weeks before commencing to excavate inside. Excavation was removed with a bucket operated from a derrick set outside the caisson, and as soon as completed for each section, the work of placing reinforcing steel and setting up forms for the next section was started. On the average, about thirty-six days elapsed between the concreting of each section, the entire operation of concreting the three sections of the ring and lowering into place taking about three months.

In the beginning, a heavy flow of water close to the surface was encountered and gave some trouble, but lower down a thick bed of clay was entered and the flow was effectually puddled out of the caisson. The top layer of soil consisted of about six feet of black loam, with another layer of the same thickness of loam and clay intermixed. Immediately below this was a four-foot bed of water bearing gravel. This upper twelve feet of soil was removed, and the shoe was set up and blocked on the gravel as bearing. After the first section had been concreted, excavation was commenced by removing the gravel from inside. The bucket used for excavating was a 21-cu. ft. Hayward orangepeel, operated from an open steel boom derrick of five-ton capacity. The derrick had a 75-ft. mast with 82-ft. boom, and was operated by a 6 x 10, double drum, double cylinder, Mundy hoisting engine with slewing gear.

All concrete, except for the two well casings, was placed by chuting from a central hoist tower about 65 ft. high, so located between the caisson and the boiler house as to reach all parts of the work. A Standard, low-charging, mixer, of 11 cu. ft. rated batch capacity, was set at the foot of the tower. A Wylie chute of 60-ft. radius was attached to the tower at a height about 45 ft. above the ground, and with the aid of short, one-arm, auxiliary chutes, was able to reach the farthest points of the work. The hoist tower was of exceptionally light construction, measuring 48 in. inside, with 4 x 4 corner posts and 2 x 6 X-bracing in panels of 5 ft. 6 in. The contractors have used this same type of tower and chute on building construction to as high as 180 ft. and have had no difficulty in maintaining its strength and stability. Such a tower can generally be used but once, and will cost about one dollar per vertical foot, dismantled.

In addition to the plant already mentioned, the contractors made use of a central boiler plant, installing a horizontal boiler of about 400 sq. ft. heating surface, which was used for supplying steam for pumping, and also to supply steam to the hoist operating the derrick and hoisting concrete. The small boiler of the hoisting engine was then in reserve, and was used occasionally. The concrete mixer was steam driven from its own engine. The 4-in. centrifugal pump was driven from a gasoline engine, so that when there was only a small amount of pumping to be done, it was not necessary to keep up the steam plant.

Graduate Course in Highway Engineering

Columbia University, New York City, has just inaugurated its first session of lecture and laboratory courses in highway engineering. All these courses are given in periods of from two to three weeks only, so that men particularly interested in certain subjects may take any course or group of courses. All the lecture courses are given during the months December to March, at a time when, presumably, engineers are least actively engaged.

This work in highway engineering and allied subjects has been arranged specially for men engaged in the practice of highway engineering, and in this particular University leads, in the case of graduates, to the degree of Master of Arts. The plan affords highway engineers, contractors, chemists, engineer-salesmen and so on, an opportunity to obtain advance knowledge during the season of the year when leave of absence can be most easily obtained. We understand the plan has the enthusiastic support of many of the foremost highway engineers and officials in the United States. On account of the international movement for the improvement of highways, many positions have been created which require men with special training. Such positions occur in the following well-defined fields: the highway departments of towns, municipalities, councils, and states; college and university faculties; the engineering and sales departments of companies dealing in materials and machinery used in highway work. We believe Canadian universities would do well to consider courses covering similar fields of operation.

The scope of the work may be gathered from the following schedule of studies for the session beginning December 1, 1915:

Highway Engineering—Highway bridges and culverts.

Highway Engineering—Management engineering.

Highway Engineering—Planning of streets and street systems.

Chemistry—Mining, manufacture, testing and inspection of bituminous materials.

Highway Engineering—Bituminous surfaces and bituminous pavements.

Highway Engineering—Mechanical appliances used in highway engineering.

Highway Engineering—Non-bituminous road materials, laboratory course.

Chemistry—Testing of bituminous materials, laboratory course.

Geology—Engineering geology.

Highway Engineering—Broken stone, gravel, and other roads; brick, stone block, wood block, and cement-concrete pavements.

Highway Engineering—Economics and design of roads and pavements.

Highway Engineering—Planning of roads and road systems.

Highway Engineering—Highway jurisprudence, highway laws, and systems of administration.

Geology—Engineering petrography.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

No, Lloyd George's son has not been made a colonel. According to reports he is full private in a Welsh regiment. Which shows that the British Munitions Ministry, unlike the Canadian Militia Department, is busier making munitions than colonels.

* * *

It now transpires that no member of the Cabinet ever asked the Canadian public for machine guns. And the question naturally arises: "If the public without being asked contributed $2,000,000 to provide our boys in the trenches with machine guns, how many million dollars worth of shells at actual cost would our factories have furnished if the Shell Committee had even whispered that the Empire needed them?" But the Shell Committee didn't whisper.

* * *

With a temperance gale sweeping over this fair Dominion at a hundred miles an hour it is almost treason to remark that the soldier will have his drink. But at the risk of being considered a traitor, an outcast and a relic of barbarism, I venture the unholy opinion that the man who cut the canteen out of the camp did a very bad afternoon's work. When the canteen was in its proper place Tommy was assured of good beer or liquor under proper restrictions. If he got exhilarated the sergeant in charge looked after him. Under existing conditions it is different. "Hunt the flask" is the favorite outdoor sport of many a hero in the making. He finds the flask, too—and in it as a rule as vile a concoction as ever insulted an honest man's throat. A man is human even when he is enough of a man to don a uniform and go out to fight for his country. And it is in human nature to hunt for liquor when you think you are being discriminated against. Tommy is proving this every day and the proof brings credit neither to his uniform nor to the man who abolished the canteen.

* * *

It was the duty of Sir Robert Borden to see that the Shell Committee, which was to have the handling of millions in contracts, was composed of men in whom the public could place the utmost confidence. What could he expect but suspicion when he appointed as that committee a manufacturer of shell making machinery, two seekers after shell contracts and a bunch of government employees? There were competent men in Canada, men with the necessary experience and business ability and who are not in line for contracts who could have been secured for the work. Why did not Sir Robert appoint them? On whose advice did he make his selections?

* * *

Safe home from their joy-ride across the continent with their select party of M.P.'s and Senators, Messrs. Mackenzie and Mann are reported down at Ottawa with their aprons held out all ready to let the Government drop another loan into them. Carrying on a war for the Empire is a small chore compared to building transcontinental railroads for private corporations. It is estimated that Canada has already given these corporations in cash and land bonuses a billion and a half. Naturally they want more, on the principle that the more men get the more they want. But they might have the decency to wait till the war is over.

* * *

When Britain was placing large orders for shells in the United States and Canadians were asking why parts of these orders were not placed in Canada, why was it that big manufacturers could get neither orders nor information concerning orders?

* * *

At the request of Sir Robert Borden, Mr. F. P. Jones, of the Canada Cement Corporation, has come forward with a sort of blanket denial of the story of his interview with the Premier re the shell game. According to Mr. Jones' statement, Mr. Thomas was not present at that interview, nor did he threaten to make a statement to the press if his tenders were not given proper consideration. He admits, however, that Sir Robert sent him to Mr. Thomas, and to ensure him due consideration in that quarter called up Lloyd George's representative and arranged the interview. In a note to the Ottawa Citizen Mr. Jones further states that at the interview arranged by the Premier Mr. Thomas informed him that tenders would be called for.

* * *

It would appear from the above that Mr. Jones is not taking the public entirely into his confidence. He neglects to mention why it was necessary to call on the Premier and later attend a Premier-arranged interview with Mr. Thomas in order to acquire the valuable information that tenders for shells would be called for.

* * *

He also neglects to mention whether he had first been to the Shell Committee with his proposition. Of course, if he had, it might be necessary to further explain why it was necessary to go to either Sir Robert Borden or Mr. Thomas in search of such valuable information as he received. Were not the Shell Committee representing Canada in regard to the purchase of shells? Were they not giving out information in regard to the asking for tenders? Were they not using their every endeavor and their undoubted business ability to secure for the Empire the munitions she needed and in the cheapest market? Apparently not, for Mr. Jones, according to his own statement, had to go first to the Premier and then to Mr. Thomas before he could discover that tenders were to be asked for. But please note the grateful sequel: "Our company again tendered, and, I am pleased to say, got business at the prices tendered by us."

* * *

Those little words "again tendered," are an indication that previous to his interviews with Sir Robert and Mr. Thomas his company had been in the field for shell contracts. Why doesn't Mr. Jones go a little further and tell the public why his other tenders had been turned down, and why he found it necessary to go over the heads of the Shell Committee before his tenders received the consideration they merited, and his factories the orders subsequent events show they were entitled to?

* * *

Mr. Jones also makes a rather complicated denial of the statement that contracts had been let at prices higher than those quoted in his tender. Let me quote the extract from his note. "The article states: 'Shell contracts were let at prices higher than those tendered by the company which I represent.' As far as I know this is not correct. When we first tendered I believe no orders were placed."

It is easy to believe that the orders had not been placed when Mr. Jones first tendered. But from his own statement it is quite evident that this tender was turned down. Neither were the orders placed before his second tender went in, after his two momentous interviews. But will Mr. Jones deny that before those interviews tenders had been accepted by the Shell Committee and sent on to Lloyd George for approval? Of course, no orders could be placed till the British Minister of Munitions approved. And will Mr. Jones deny that he is now making part of those munitions at a price lower than the tenders accepted by the Shell Committee?

* * *

Blanket denials are not explanations, and it is explanations that are in order at the present time. Mr. Thomas has stated that "profits of the manufacturers have been higher than they were entitled to"; the Shell Committee has been allowed to drift into oblivion, and evidently requested to do its drifting with the least possible noise; it has been replaced by a Munitions Committee, which is in the hands, and evidently under the complete control, of Mr. Lionel Hichens, who has come out from England as the personal representative of Lloyd George. What does this all mean? Why, if the story told in this column is not true, was the Shell Committee abolished? Why does Lloyd George find it necessary to send a man to Canada to boss the job? Why is Mr. Jones unable to get a contract till he calls on Premier Borden and Mr. Thomas, neither of whom has the power to award contracts, and "again" tenders? In short, if the Contract Record is wrong what is the right of our story?

* * *

This column admitted on the start that it was impossible to get sworn statements. It is so still. Consequently, it is impossible to be exact as to details. But the essentials of the story of the breaking up of the shell game have yet to be denied. The interviews between Mr. Jones, Sir Robert Borden and Mr. Thomas took place. They were followed by the disappearance of the Shell Committee. A report was sent out from Ottawa that all munition contracts had been cancelled. A competitive system of tendering replaced the old haphazard system. And big firms got contracts who had not been able to get even information concerning them before.

* * *

Just why it is impossible to get exact details is perhaps shown by several letters addressed to this column. They come from contract holders in Toronto, and in each case the writer complains that his firm can't get any more contracts because it is accused of "giving things away." And the sad part of it is that not one of the accused disclosed one word that has appeared in this column.

* * *

It is in no spirit of cavilling criticism that those facts are presented to the public. This column has no political axe to grind. It wants neither a contract nor an honorary colonelcy. But it would like to see the factories of Canada as busy as thorough organization to meet the demands of the Empire could make them. Britain is spending one hundred million dollars a week in the United States. She is spending twenty-four millions a month in Canada. Some people may figure from this that Canada is getting her fair proportion, and if you like to figure negroes of the south, the hyphenated Germans of the east and the Austrians and Hungarians of the middle west as "population" of the republic, perhaps they are right. But, as Mr. Thomas states, Canada is entitled to a slight preference. This preference should not show in the prices, but in the placing of orders, provided prices and goods are the equal of those that can be purchased elsewhere.

* * *

There is not the slightest doubt but that if the industries of Canada were organized or mobilized, and their output ascertained, that every factory capable of turning out munitions could be kept running night and day. Canada might just as well be furnishing the Empire with fifty millions of munitions a month as the twenty-four millions she is turning out now.

* * *

But did the Government make any endeavor to organize Canadian industries? On the contrary they turned the whole matter over to the famous Shell Committee, who formed a new family compact, discouraged manufacturers and so conducted things generally that David Lloyd George adopted as his motto "Put not your faith in Canadians," and sent a man over from England to do such buying as would keep the Dominion from becoming peevish.

* * *

The Toronto Telegram advises the Government to emulate Britain and appoint a big man as Minister of Munitions, even as Britain appointed Lloyd George. And perhaps if the suggestion were acted upon it is not too late for Canada to get a fair share of the business arising out of the war. But there are two things in the way. The first is finding the big man, and the second is divorcing politics from business in any transaction in which any Canadian Government has a hand.

* * *

Several British generals with great records behind them have been recalled from the front. and it goes without saying that the cause of this recall has furnished the slackers around the club fireplaces with many a dainty morsel of gossip. But we who stay at home should be slow to criticize the man who has gone to the front. He has seen his duty and has done it to the best of his ability. If he has made a mistake he is none the less worthy of our respect. Let us who have made excuses rather than mistakes be careful. In the last grand analysis he who has tried and failed will show a larger percentage of solid man than he who has stayed at home and criticized.

* * *

Brig.-Gen. Bertram has come forward with an excuse for the fearful and wonderful way in which shell box contracts have been awarded. And like many another the Brigadier has shown a bravery that could be utilized at the front rather than a wisdom that can be used in council. His first words show that he either has been given a job too big for him or that he has something which it would not be politic to expose to the rude gaze of the public. "We have to deal with millions of dollars worth of orders," he exclaims, "and some three hundred and fifty or more manufacturing concerns. It is not to be wondered at if some company or some middleman puts it over us occasionally." And this is his excuse for giving an order for shell boxes to a company whose business is the building of dams!

* * *

Surely Brig.-Gen. Bertram does not wish the public to understand that the Shell Committee hands out contracts to the lowest, or rather the favored, bidder, without enquiry as to the bidder's equipment, business, or other qualifications for carrying out the work. An excuse of that kind is too flimsy to do duty even for a government committee that was apparently responsible to nobody or anything but its own conscience—which turns out to be only a political conscience.

* * *

Brig.-Gen. Bertram's confession of the incompetency of the Shell Committee is full justification for its abolition. But the trouble is that the evil done by committees does not die with them. This one has by its actions retarded the supply of munitions to the Empire when it most needed them, and it has lent itself to the creation of an impression, both here and in England, that the Government of this Canada of ours, which is giving its sons by the hundred thousand to keep the old flag flying, still places politics before patriotism.

* * *

A German paper called "The Fatherland," published in the United States, in a recent issue prints a conglomeration of the most senseless misrepresentations with regard to Canada that it has ever been my misfortune to run across. It is worse than lies—it is German stupidity at its best.

For example, "In all Canadian towns and countrysides, from British Columbia to Quebec, the Canuck has run riot, typifying himself with brutal Cossack deeds. He burned houses, plundered shops, stoned unfortunate men, women and children in city streets and country roads, no one deterring him. German, Austrian and Hungarian men and women were dragged from their homes and slaughtered in the open. Sons who defended foreign born parents were slain and the daughters were brutalized by the mob."

There is much more of this same sort. The only comment that appears to fit the occasion is that it was written by a stupid German. As a matter of fact Canadians have decidedly erred on the side of leniency and humanity. I know of one case where a Canadian battalion guarding interned Germans and Austrians were suffering from lack of suitable shoes—the interned enemy had been outfitted first and their food was better than that of the troops.

And again, "The dreadful fact was driven home to the plutocrats of England that workingmen, whom they had ground down to pauperism, would absolutely not go to war for them. They conferred in council and sent out instructions to their satraps in many lands 'drive in men from the colonies and make them fight.'"

This may be just the ordinary German way of telling a lie and there is one possible chance in a million that the writer did not know the facts. No one in the colonies has been forced to fight. Whatever the future may bring forth, military service throughout the British Empire up to the present time is entirely voluntary. It will be of interest to The Fatherland to learn (giving them the benefit of the doubt and supposing them only ignorant of the fact) that those sections of Canada inhabited by citizens of German parentage, for example Berlin, Ontario, are right in the forefront with subscriptions for British Red Cross work, patriotic funds, Belgian relief funds and so on, and that they are even now enthusiastically raising a German-Canadian battalion in this same Canadian Berlin to fight for Old England.

And again, speaking of the recent Dominion government loan in New York of some $45,000,000, "Canada has placed this loan with the money trusts at ruinous rates of interest, as all bankrupts must do." Again The Fatherland will be pleased to learn, as, of course, it has not heard about it, that this loan bears only 5 per cent. and was quickly taken by the public at 98. Not what one would exactly call a "ruinous" rate, especially when compared with the German government securities offered recently by a New York firm at a price to yield the investor approximately 8 per cent. And that was some time ago. Germany could doubtless not get such "favorable" terms in the United States at the present time.

* * *

And, by the way, might not some of the time that is being spent in our schools in the study of the German language be more usefully employed in mastering some of the rudiments of our own? Inaccuracies in spelling, grammar, punctuation, and pronunciation among Canadian citizens are almost common enough to make them the rule rather than the exception. A knowledge of the German language will doubtless continue to be useful in the commercial world, as it has been in the past, but does it not appear as if we might at the present time dispense with much of the surplus 'kultur' which is being forced on many of our young people, until such time at least as they have learned to appreciate that a more real culture may be gained from fuller appreciation of the grammar and literature of our own nation.

Dern Yer, Come Out and Fight!

The front door is soundly timbered and safely locked. The small boy stands in the parlor, looks through the window to the streets, valiantly sticks his tongue out at the boy with the clenched fist on the sidewalk, and says, "Dern yer, come out and fight!"

How falls it that Americans, in awarding to the British the palm for imperviousness to the pricking point of wit, have managed to overlook the Teutonic cousin? The plate of British receptiveness to humor's flashing message is delicately sensitive when compared to that of Kultur's propagandists, who to-day, standing on the decks of sequestered ships, look out over the protecting mine fields and the beetling batteries of Heligoland, and send forth the challenge to the free roaming British sailorman, "Dern yer, come out and fight!"

War's humors usually are grim, but this last double-leaded, triple-columned tale of defiance which comes cabling and hurtling out from the safe recesses where the German Dreadnoughts and the German Donots at anchor lie, is as rollicking a thing as wit's recital ever gave to humor-loving eye or ear.

The sole sad thing about this story from the Teutonics' cloistered fleet is that its writer takes it so all-fired seriously and has such a child's faith that the world will be serious with him.

"Dern yer, come out and fight!"—Washington Times.

High-Class Concrete Specialties

The Art Stone Company, Waynesboro, Penn., for some time has been successfully using Medusa White Portland cement in concrete marble making and in a great variety of decorative concrete work. The illustration herewith gives an idea of the artistic possibilities of concrete for exterior and interior use, such as exterior trim, porch work, lawn and garden accessories, floor, wainscot, mouldings, table tops, bank and store counters, bases, for show cases, interior fireproof trim, etc., over one hundred styles being shown. By their formulae, processes and methods they claim to be able to imitate any marble, granite or onyx, from a pure white to all the various shades and colors desired, at a cost of about one-fourth that of natural marble, and in this Medusa White Portland cement is an important factor. Coloring is used in the facing surface only, which is permanent and will not fade, and takes a polished finish direct from the molds, while the body of tile is of cement. The photograph, of course, fails to reproduce the colors, veinings, &c.

New Books

Railway Maintenance Engineering—by William H. Sellew, A.S.M.E.; D. Van Nostrand Company, New York, publishers; price $2.50 net. The author has prepared this book from notes used in his classes in railway engineering at the University of Michigan but has introduced matter of a sufficiently advanced character to make the book of real value outside the classroom. The work is confined to the principles of maintenance, as railway development has now reached the stage where it is intensive rather than entirely extensive, so that younger engineers at least are probably more concerned with the study of improvements on existing lines than in the laying of new ones. Owing to increasingly heavy loads tracks are more severely taxed than was formerly the case and the need for more scientific methods in maintenance is being realized. The scope of the book may be gathered fairly from the following chapter headings: Engineering; Land; Grading; Bridges, Trestles and Culverts; Ties; Rails; Other Track Material; Ballast; Maintaining Track and Right of Way; Station and Roadway Buildings; Water Stations; Fuel Stations; Shops and Engine Houses; Icing Stations; Signals and Interlockers. The book is well illustrated; 350 pages; size approximately 5 in. by 7½ in.

Letters to the Editor

An Open Letter to Consulting Engineers, City Engineers and Others

Calgary, Alta., Nov. 1, 1915.

Editor, The Contract Record:

The City of Calgary are building a reinforced concrete high level bridge costing approximately $400,000. This bridge is now in course of construction, and lately a difference of opinion arose between an alderman of the city and the city engineer as to the relative merits of the reinforcing steel used in said construction.

The city engineer appeared to be holding his own in this discussion relative to his administration, when the local branch of the Canadian Society of Civil Engineers butted in on the grounds that the matter was of a technical nature, and the citizens did not understand the matter; thereby the said society constituted themselves a board of trial and offered their services to the City of Calgary free of all charge, which was accepted by the mayor and commissioners of Calgary, thereby throwing a serious reflection upon the engineering department of the city.

Aside from the value that is put upon offered and unsolicited services, the Canadian Society of Civil Engineers will be in a peculiar position should the City of Calgary later on decide to submit the whole matter to an independent engineer for his opinion which may be adverse to the opinion given by the said society.

Yours truly,

Justus.

Philadelphia, Nov. 1, 1915

Editor Contract Record:

Re the laying of bituminous wearing surface on old macadam roads.

We have for several years laid bituminous wearing surface on old macadam roads after scarifying them and adding as much new stone as may be necessary, then thoroughly rolling, screening and flushing the road as would be the case in completing an ordinary macadam road except that the application of screenings on top of the stone is not put on. In other words, the purpose is to fill the road with screenings to within about ⅛ in. from the top of the stone and thus enable the bituminous wearing surface to key in with this foundation. On this foundation if you place a 2-in. wearing surface consisting of a properly graded aggregate with the right kind of binder and correct percentage of the same, and the work is well done according to the best practice, it will be a satisfactory pavement for ordinary traffic conditions, but it would not of course be an economical pavement for a city street with very heavy traffic. There is a statement in Mr. Blackman's letter to you (C. R. Sept. 29) that this pavement would be fifty per cent. cheaper than an ordinary pavement. That of course depends upon the price paid in each individual case for constructing this type of pavement, and it furthermore must be taken into consideration that there is very little cost for the foundation, as you are using the old macadam foundation. Therefore you are just paying for touching up this and laying two inches of wearing surface.

I might state that instead of using the old macadam foundation in work of this character, I am laying a concrete foundation, using the stone in the old macadam road or such of it as is fit to be used in the mixture. In short, the type of bituminous pavement described above, on an old macadam road, is used to a large extent and will result in giving a good pavement. I believe, however, that the very slight additional expense of laying a concrete foundation, using such of the old stone as may be used, will give a better foundation and result in giving a better pavement, and is therefore justified.

I am sending you a copy of my standard specifications for country road work, describing both of these methods of construction, in which I have marked the paragraphs relative to this type of pavement.

(1) The following has been the average cost in this city of laying a 2-in. bituminous pavement of the very best type on an old macadam foundation. The price includes adding about 2 in. of stone to the old macadam road and rebuilding it, and not only the cost of the material of the 2-in. wearing surface but the completed road: $0.90 per square yard.

(2) The cost of a completed pavement of this type including the 4-in. concrete foundation and the 2-in. wearing surface is as follows: $1.174 per square yard.

(3) The cost of a completed pavement including the 5-in. concrete foundation and the 2-in. wearing surface is as follows: $1.328 per square yard.

Yours very truly,
W. H. CONNELL.
Chief of Bureau of Highways
and Street Cleaning.

Pro Patria

Lieut. G. W. N. Day, editor of the Contract Record, has accepted a commission with the 95th Battalion now in course of formation by Col. R. K. Barker. Lieut. Day, like many another good man and loyal British citizen, has not hesitated to sacrifice the prominent position he had attained with his company through some eight years of hard work, backed by ability of a high order, at his country's call. Indeed, if guarantee other than his own personality were needed, the almost 'national' character which the "Contract Record" has attained under Lieut. Day's guidance would amply justify our confidence that he and the men under his command will give a "British" account of themselves in the battle-line. The members of the staff he leaves behind, with his many friends throughout the Dominion, wish him God-speed and "a happy issue." Lieut. Day was born in Hastings, Sussex, Eng.

Lieut. G. W. N. Day

Personal

Mr. F. P. Adams, city engineer of Chatham, Ont, has left for London, England, where he will take a course to qualify for a captaincy.

Mr. C. A. D. Bayley, hitherto Eastern manager of the Foundation Company Limited, Montreal, has been appointed manager for the Dominion of Canada.

Mr. William Earland, a South Vancouver contractor, is leaving for the front with the 47th Battalion. Mr. Earland already has six brothers and two brothers-in-law on active service. 9

Mr. G. W. Britnell, of Toronto, was presented with a purse and a wrist-watch by his fellow-members on the Builders' Exchange on his leaving the city to join the overseas forces at Montreal last week.

Engineer West, of the engineering department of the city of Vancouver, who enlisted for active service with the Sixth Field Company, Canadian Engineers, some weeks ago, is leaving for the front shortly. He has been granted leave of absence for an indefinite time by the city council. In the meantime his position will be filled by Mr. A. R. Clucas, acting engineer.

Mr. L. W. Wynne-Roberts has resigned from the staff of the Board of Highway Commissioners, and is leaving Regina to accept a commission with the Royal Engineers in England. Mr. Wynne-Roberts has been in Regina since 1912, and is well known in engineering circles. He is a member of the Regina Engineering Society, and was secretary of the Regina Branch of the Canadian Society of Civil Engineers. He is a son of R. O. Wynne-Roberts, consulting engineer, Toronto.

Obituary

Israel L. Longley, a well-known contractor and builder of St. John, N. B., died recently.

Mr. W. H. Kennedy, a well-known mechanical engineer of Toronto, died a short time ago.

The death occurred in Vancouver recently of Mr. Henry W. Kensit, a civil engineer employed by the Canadian Northern Pacific Railway.

Mr. Richard Mahoney, an engineer and contractor of Guelph, Ont., died recently. He had been closely connected with building operations in Guelph for many years.

John H. Challoner, a well-known resident of Kenora, Ont., and one of the engineers engaged in the construction of the Hudson's Bay Railway, died recently at the age of sixty-seven.

Mr. William Snider, for fifteen years Road Commissioner of Vancouver Island, died recently. The late Mr. Snider constructed many of the trunk and municipal roads in the vicinities of Vancouver and Victoria.

Lieut. G. Stafford Boyle, R.E., a native of New Zealand, but who at the time war was declared was employed on the I. C. R. engineering staff at Moncton, N. B., is reported dead from wounds received in the Dardanelles. The late Lieut. Boyle enlisted as a private with the first contingent, but shortly after his arrival in England received a commission.

Mainly Constructional

East and West—From Coast to Coast

Gourre & Company, contractors, Montreal, have registered.

The Villeneuve Machine Gun Company, La Tuque, Que., have obtained a charter.

D. Maxwell & Sons, Limited, of St. Marys, Ont., are working full time on shells.

The American Well Works Company, of Aurora, Ill., are establishing a Canadian plant at Chatham, Ont.

The Confederation Sand and Gravel Company, Limited, St. Catharines, Ont., have obtained a charter.

Four New Westminster, B. C., firms have had apportioned equally between them an order for 150,000 shells.

Good progress is being made on the new filtration plant at Cartierville, Que., which is being erected at a cost of $100,000.

There were ninety-six applicants for building permits made at the office of the Toronto City Architect the week before last.

The building permits issued by the town of Chatham, Ont., this year already show an increase of $44,459 over those of 1914.

From the beginning of the year up to the end of October the municipality of South Vancouver spent $43,330 on sewer construction.

Statistics show that no fewer than one hundred and fifty-one cities and towns in Canada are now working on orders for munitions of war.

The Eclipse Iron Works, Limited, has been incorporated with a capital stock of twenty thousand dollars and head office at Vancouver, B. C.

Work in connection with the new water-works scheme at Markham, Ont., is now well under way. Several hundred feet of pipe have been laid down in the main street.

It is understood that J. McDiarmid & Company, the contractors for the bridge in connection with the Georgia-Harris viaduct, will sue the city of Vancouver for $15,462.

St. Marys (Ont.) Cement Company are working overtime, and Mr. Lind, the manager, states that, in spite of the war, this year has been the best in the history of the plant.

An additional order for five thousand shells has been awarded to a Calgary firm which has already turned out some of the highest grade munitions of war produced in the Empire.

Owing principally to a reduction in the number of students due to enlistment, the Engineering Society of the Faculty of Applied Science of the University of Toronto has been disorganized.

Architect La Chance, in reporting on the Adelaide Hoodless School, Hamilton, Ont., charged that the work was not up to specifications, and that the contractors saved $6,786 in this way.

The Wentworth County Council have deferred action on the by-law to raise ten thousand dollars for machine guns because of the despatch from Ottawa that money was not required for this purpose.

The Canadian Steel Corporation, Limited, of Calgary, have forwarded to Toronto a cheque for five thousand dollars to be divided equally between the Canadian Red Cross and the Canadian Patriotic Fund.

It is probable that the new warehouse at Regina being constructed for The Robert Simpson Company of Toronto by Wells Brothers of Chicago will be completed by Christmas. The forms are being constructed, and concrete poured on the eighth storey.

Controller Cote will represent Montreal at the International Good Roads Congress to be held at Worcester, Mass., on December 14-17, while Mr. U. H. Dandurand will be the delegate of the Automobile Club of Canada, Montreal.

The Ontario Steel Products Company is stated to have closed a contract for trench-digging shovels which is larger than any previous contract of the kind yet placed in Canada. They are already sending forward consignments weekly to different camps.

Mr. James Milne, Toronto water-works engineer, is being "loaned" to the Windsor Water Commission for a day or two despite the fact that Commissioner Harris opposed it on the grounds that he would be taking the work from a consulting engineer.

The Standard Ideal Company, Limited, of Port Hope, Ont., have received from the Shell Committee at Ottawa an order for shells worth over a quarter of a million dollars. The contract calls for the machining and assembling of sixty-pounder high-explosive shells.

Mr. George H. Gooderham, Chairman of the Toronto-Hamilton Highway Commission, announces that the work on the new roadway will be completed in a year's time. Nine hundred men are being employed on the work, and they are building at least a quarter of a mile a day.

The Dominion Equipment and Supply Company, Limited, Winnipeg, recently sold to the Winnipeg Aqueduct Construction Company a class 20 and a class 24 Bucyrus drag line excavator for use on the Greater Winnipeg Water District contract. This makes a total of eight Bucyrus drag lines on this work.

The recently organized Port Moody Steel Works, Limited, are busy cleaning up their site at Port Moody, B. C., and expect to begin work on the construction of their buildings soon. They hope to be able to start business operations early in the new year. The plant will be one of the most modern in the Dominion.

The Corbett Foundry and Machine Company, Owen Sound, Ont., have secured contracts for shell-making machinery which will keep their plant running to full capacity for from six to nine months. The orders are for engine lathes and thread millers, both of which are used in the manufacture of shrapnel and high-explosive shells.

Montreal Stone Specialties, Limited, is the name of a company incorporated recently to carry on business as quarry masters and stone merchants. The capital stock of the company is fifty thousand dollars, and the head office is at Montreal. The incorporators include N. Dubuc, Senr., David Monette, N. Dubuc, Junr., and J. O. Labrosse, all of Montreal.

Quebec is one of the cities which is showing up well in the building line. For October the permits were valued at $200,025—a gain of $91,495. The permits for the ten months were not up to those of 1914 in value, although the number was more than double that in the corresponding period of last year. The figures were $2,114,951 in 1915 against $2,374,744 in 1914.

A Canadian Overseas Railway Construction Corps, organized by Lieut.-Col. F. L. Wanklyn, of the C. P. R., will reinforce the force which, under Lieut.-Col. C. W. P. Ramsey has been doing excellent engineering work in France and Belgium. Most of the new draft of 120 men were in the employ of the C. P. R. and nearly all come from the West. They are all practical railroad construction workers, and do not include any engineers. One man travelled over 6,000 miles to join. All the members are above the average height and weight, and physically are an exceptionally fine body of men. The corps is in charge of Lieut. H. B. Sims, at one time assistant divisional engineer at Vancouver.

The Regional Construction Company, Limited, has been incorporated, with head office at Montreal and a capital stock of one hundred thousand dollars. The new company will carry on business as contractors and builders of railways, roads, aqueducts, canals, bridges, etc. The incorporators include C. G. Hebert, A. Laberge, E. H. Godin, and J. E. Morier, all of Montreal.

The Confederation Sand and Gravel Company, Limited, has been incorporated to deal in sand, gravel, stone and ballast. The capital stock of the company is two hundred thousand dollars, and the head office is at St. Catharines, Ont. The incorporators include W. H. Hutchinson, of St. Catharines, W. B. Russell, of Toronto, and E. A. Larmonth and R. A. Pringle, of Ottawa.

A shell-manufacturing concern has been incorporated under the title of the Transcona Shell Company, Limited, with head office at Montreal. The company will also manufacture guns, mortars, howitzers and cannon of all calibres, gun carriages, and ammunition wagons. The incorporators are F. G. Bush, G. R. Drennan, M. J. O'Brien, H. W. Jackson, and F. B. Common, all of Montreal.

In connection with the Panama Canal slide, dredges have been removing earth at the rate of more than 1,000,000 cubic yards a month—an average of 35,000 cubic yards a day. The canal engineers report that the dredges are able to maintain the channel they cut, and that the tendency of the canal bottom to bulge upward gradually is ceasing. It will probably be a month, however, before the waters again meet, and it is not expected that the canal will be in a fit condition to be used before the first of the year.

It is stated that the Toronto and Hamilton Highway Commission will demand from the Hamilton city council proof of the statement made by Alderman R. M. Roy, Chairman of the Works Commission, that serious mistakes have been made and much money wasted on the construction of the highway. The controversy arose following an inspection of the highway by Alderman Roy and other Hamilton city officials last October.

The Foundation Company, Limited, Montreal, are constructing a concrete gravity type dam on the Lievre River for the Electric Reduction Company, Buckingham, P. Q., from plans by Mr. John McRae, Ottawa. This replaces the present wooden structure. Last winter the Foundation Company put in stop logs in connection with the Reduction Company's hydro-electric plant, and the new dam is part of a programme of contemplated improvements.

Mr. Justice Maclennan, in giving judgment in suits taken against the city of Montreal by workmen injured while in the city's employ, has ruled that workmen employed otherwise than on water-works or similar industries operated for profit cannot sue under the terms of the Workmen's Compensation Act. Thus a man employed in the water-works, which is a source of revenue to the city, could sue under the terms of the Act, while a man working on repairs could not.

A Winnipeg paper is authority for the statement that the Government of Manitoba had agreed to accept a sum of something like one million dollars as restitution from Thomas Kelly in settlement of the pending civil action, but that the criminal action would still proceed. The Government, it is said, hope to obtain a better settlement through the courts. Their claim is for about one and a quarter million dollars, this being the total of the extras with which the original Parliament Bu9ildings contract was embellished.

Mr. R. A. Penhale, of St. Thomas, speaking at the tenth annual convention of the Ontario Horticultural Association at Parliament Buildings, Toronto, recently, said that the roadsides should be better levelled. This would add considerably to the appearance of the road, and prove a large factor in getting rid of weeds. In his report the Superintendent of the Association, Mr. J. Lockie Wilson, stated that the year had been one of satisfactory progress. Seven new societies had been formed, and the total membership was now upwards of 14,000.

The Dominion Conservation Commission, Ottawa, in an effort to reduce the great annual fire loss in Canada, are taking up the matter of establishing a general building by-law to cover all the provinces and secure some uniformity of construction. The Commission have asked a number of city architects of the chief cities of Canada to give their opinions as to what such a national building by-law should contain. Mr. Pearse, city architect of Toronto, has suggested that it would be a great help if a central bureau were maintained where municipalities could get information in reference to the fire-resisting qualities and the strength of various materials used in buildings: at present city departments are forced to obtain such information from fire underwriters or from United States cities. Mr. Pearse is of the opinion that, on account of differences in climate, physical condition, water, supplies, and so on, it would be impossible to have a uniform building by-law for the whole Dominion.

Last week a large deputation from Mimico representing the Mimico Board of Trade and the village council waited on Commissioner Geo. H. Gooderham to ascertain what the Toronto-Hamilton Highway Commission proposed to do in regard to making the route of the highway through the village. The deputation was headed by President J. M. Gormley, who explained that the residents of Mimico were disappointed at the suggestion to divert the highway at Long Branch along Queen Street to the Lake Shore Road at the Humber. Mr. Gooderham said that the reason for the proposal was the high land damages asked by owners along the route first chosen. As a result of the discussion the following gentlemen were appointed to go into the cost of land damages by meeting property holders and to report on all other extra costs on the Lake Shore Road route: Messrs. A. B. Ormsby, Fred Hall, M. A. Collett, and John Kay, with engineer T. Lowes to advise.

Canadian Trade Gains

For September

	1914	1915
Imports	$36,567,572	$38,026,720
Exports	40,544,094	53,715,882

For the 12 months ending September

	1914	1915
Imports	$531,853,489	$417,272,203
Exports	468,210,010	517,982,240

This is a gain of over $100,000,000 this year, against a loss of over $60,000,000 last year.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Berlin, Ont.
The City Council are considering the construction of a concrete pavement on Queen Street. Work will start in the spring. Engineer, H. Johnston.

Cornwall, Ont.
The Town Council are considering the construction of watermain extensions and the purchase of a pump. A by-law will be submitted to the ratepayers on January 1st. Approximate cost, $25,000. Clerk, J. G. Harkness.

London, Ont.
The City Council have authorized the construction of cement sidewalks on Egerton Street S., a 15-inch tile sewer on Dundas Street and an 8-inch sewer on Adelaide Street. Work will start shortly. Engineer, H. A. Brazier.

Princeville, Que.
The Town Council contemplate the erection of a pump station and the purchase of 4-inch and 6-inch cast iron pipe, valves, pumps and hydrants.

Sombra Township, Ont.
The Township Council contemplate the construction of a number of drains. Particulars from W. A. Scott, Wilkesport Ont.

St. Hyacinthe, Que.
The City Council will receive tenders until noon, January 11th, for excavation, concrete work, superstructure and mechanical equipment required in the construction of a filtration plant with a capacity of 3,000,000 gallons a day. Plans and specifications with the Engineer, H. Cadieux, and at the office of MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto. Estimated cost, $75,000.

St. John, N.B.
Work by day labor has been started on extensions to the water and sewage systems on Portland Place. Construction is supervised by City Engineer William Murdock. Approximate cost, $4,600.

Toronto, Ont.
The Board of Control will receive tenders until December 7th for a quantity of sewer construction. Plans at Room 6, Department of Works, City Hall.

The following work has been recommended by Commissioner R. C. Harris: asphalt pavements, $126,800; asphaltic concrete pavements, $4,400; brick block pavements, $12,560; sanitary sewers, $13,000; storm sewers, $43,500.

CONTRACTS AWARDED

Berlin, Ont.
The following contracts for pumping machinery, etc., have been let by the City Council:—pumping machinery, Canadian Allis-Chalmers, Ltd., King Street W., Toronto, $4,492; piping, Gartshore-Thompson Pipe & Foundry Company, Stuart Street W., Hamilton, $7,074; valves, Kerr Engine Company, Walker Road, Walkerville.

Cartierville, Que.
In connection with the filtration plant now being constructed for the Town Council, the contract for asbestoslate roofing has been let to the Asbestos Manufacturing Company, Ltd., 511 St. Catherine Street W., Montreal.

Grantham Township, Ont.
The Township Council have let the contract for the construction of tile drains to A. R. Deconza & Son, 9 Ontario Street. Council will furnish material.

Hamilton, Ont.
The City Council have let contracts for the construction of sewers to J. J. Armstrong, 116 Burris Street, for Barton, Brock and Britannia Streets, and to S. Cheeseman, 644 King Street W., for King and Roxborough Streets.

Railroads, Bridges and Wharves

Chatham Township, Ont.
Bulk or separate tenders on the construction of fourteen steel and concrete bridges over the Big Creek Drain will be received until November 27th by W. H. Wickens, Skane Block, Chatham. Engineers, McCubbin & McGeorge, 135 King Street, Chatham.

London, Ont.
The City Council have decided to lay a new floor on the Blackfriars Bridge and repair the flooring of the King Street Bridge. Engineer, H. A. Brazier.

The London & Port Stanley Railway Board are considering the construction of three new switches and the extension of the railway three blocks west of the present terminus. Manager, J. Callaghan.

McNab Township, Ont.
The Township Clerk, John McGregor, R. R. No. 1, Renfrew, will receive tenders until 6 p.m., December 14th, for the construction of a wooden bridge over Waba Creek. Specifications at offices of the Clerk and of R. M. Stewart, Braeside, and at the Post Office, Waba.

Midland, Ont.
James Playfair & Company have decided to rebuild their dock in the spring. Cedar and pine lumber will be required.

Vancouver, B.C.
The A. W. Creelman Company, 1651 Laurier Avenue, Vancouver, are receiving tenders on the sand, gravel, cement and iron required in the construction of the sea wall at False Creek.

Public Buildings, Churches and Schools

Berlin, Ont.
Tenders will be received until 4 p.m., December 3rd, by the Department of Public Works, Ottawa, for the installation of electric wiring and fittings at the Post Office. Plans and specifications with Thomas A. Hastings, Postal Station F, Toronto, at the Post Office, Berlin, and at the Department. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Briercrest, Sask.
The Trustees of School District No. 3479 have been authorized to borrow $6,000 for the erection and equipment of a school. Treasurer, R. J. S. Gilroy, Briercrest.

Dunblane, Sask.
Permission has been granted to the Trustees of School District No. 3465 to borrow $3,000 for the erection and equipment of a school. Treasurer, G. H. Hogarth, Dunblane.

Freeport, Ont.
The Waterloo County Council have purchased a site on the Preston-Berlin Road for the erection of a House of Refuge. Type of buildings not yet determined. Clerk, H. J. Bowman, Berlin.

Ingersoll, Ont.
A by-law providing for the erection of a school on Thames Street will be submitted to the ratepayers on January 3rd. Approximate cost, $70,000. Town Clerk, W. R. Smith.

Louisburg, C.B.
Tenders are now being received for the heating and plumbing required at the school now in course of erection for the Town Council. Chairman of the School Board, W. E. McAlpine.

Motherwell, Ont.
George Thompson, Chairman of the School Board, or W. W. Rogers, Secretary, will receive bulk or separate tenders for all trades required in the erection of a school. Plans and specifications at Eizerman's Planing Mill, Mitchell, and with John Murray, Motherwell. Closing date, noon, January 1st.

Orillia, Ont.
The by-law to provide $50,000 for the erection of Municipal Buildings has been defeated.

Peace River Crossing, Sask.
Permission has been granted to the Trustees of School District No. 2526 to borrow $7,500 for the construction and furnishing of a school. Secretary, H. A. George, Peace River Crossing.

Portage la Prairie, Man.
The Department of Public Works, Ottawa, will receive tenders until 4 p.m., December 7th, for the installation of electric wiring and fittings at the Public Building. Plans and specifications with the Caretaker, Public Building, Portage la Prairie, H. H. Matthews, Architect, Winnipeg, and at the office of

the Chief Architect, Ottawa. Specifications only at office of MacLean Daily Reports, Limited, 25 Charlotte Street, Toronto.

Stanger, Sask.
The Trustees of the Divide School District No. 3209 have been empowered to borrow $5,000 for the erection and equipment of a school. Secretary, George Carter, Stanger.

St. John, N.B.
Work by day labor has been started on the erection of a gymnasium in connection with the Roman Catholic Church on Cliff Street. Construction is supervised by John Flood, Duke Street. Brick construction, felt and gravel roofing. Architect, R. A. Frechet, 30 Bonnacord Street, Moncton.

Toronto, Ont.
The Board of Education will receive tenders until November 26th for ventilating fans, iron fence, ash hoist, local telephones, art glass, bronze tablet and steam fittings at various schools. Specifications at office of the Superintendent of Buildings, City Hall.

CONTRACTS AWARDED

Hamilton, Ont.
The contract for the installation of plumbing, gasfitting, etc., at the City Hospital, Barton Street, has been awarded by the City Council to Adam Clark, 7 Main Street West.

Montreal West, Que.
The general contract for the erection of a Sunday School for the Montreal West Methodist Church, Brock Avenue N., has been let to D. F. Deslauriers, 343 Richelieu Street. Approximate cost, $3,000.

Port Colborne, Ont.
The contract for electrical work required at the school now in course of erection has been let by the Public School Board to George Reid & Company, 90 Main Street E., Welland.

Rothesay, N.B.
The contract for electrical work at the school now in course of erection has been let by the Consolidated School Board to the Vaughan Electrical Company, Germain Street, St. John.

Business Buildings and Industrial Plants

Acton, Ont.
D. A. Henderson has decided to rebuild his sawmill, which was recently destroyed by fire. Loss, $4,000.

Eustis, Que.
All work required on the buildings which are being erected for the Eustis Mining Company will be done by the general contractors, Loomis Lakin Ltd., St. Gabriel Street, Sherbrooke.

Forest, Ont.
W. B. McCallum, Pickering Farm, is about to erect frame poultry buildings.

Leamington, Ont.
S. G. Morse is considering the erection of a warehouse to cost about $25,000. Plans will be prepared shortly.

Listowel, Ont.
Nathan Calder is about to commence the erection of a planing mill, estimated to cost $5,000. White brick construction, felt and gravel roofing.

Merlin, Ont.
A. Gosnell has started work on the erection of a warehouse, estimated to cost $5,000. Concrete block construction, concrete foundation, felt and gravel roofing.

Montreal, Que.
A. Proulx, 1807 Masson Street, has commenced the erection of a store and two flats, estimated to cost $3,000. Brick construction, felt and gravel roofing.

A. F. Byers & Company, 340 University Street, have started work on alterations to the warehouse of the Carter White Lead Company, 91 Delorimier Street. Brick construction, felt and gravel roofing. Estimated cost, $5,000.

J. O. Legault, 364 Beaubien Street, has commenced the construction of a store front and other improvements at the premises at 2576-2578 St. Hubert Street. Brick construction, concrete foundation.

A. Millette, 189 Christophe Columb Street, has commenced the erection of a store and residence, estimated to cost $6,000. Brick construction, concrete foundation, felt and gravel roofing.

Muncey, Ont.
James R. Price intends to rebuild his two barns next May.

Pembroke, Ont.
J. E. Whelan is considering rebuilding his business block, which was recently destroyed by fire. Work will probably start next spring. Brick construction.

Phone Hill, Sask.
The Canadian Northern Railway Company, Winnipeg, propose to build a station this fall. Purchasing Agent, E. Langham, Winnipeg.

Port McNicoll, Ont.
The Canadian Pacific Railway (Steamship Department), Montreal, have acquired the hotel and are making improvements and decorating the premises. Superintendent of work, J. S. Byron, Port McNicoll.

Putnam, Ont.
R. Clifford is considering the erection of fireproof barns to replace those destroyed by fire. Approximate cost, $3,000.

Salmon River, N.B.
The Pejepscot Lumber Company have decided to rebuild their sawmill next year. A temporary mill may be erected this winter.

St. Hyacinthe, Que.
Work is progressing on the erection of a picture theatre for N. D. Bouchard, St. Hyacinthe. All work is being done by owner.

St. Thomas, Ont.
Henry Freeman has decided to rebuild his barns in the spring.

Toronto, Ont.
The Willys-Overland Ltd., are considering the erection of factory buildings on the Weston Road, near the premises of the Russell Motor Car Company. Vice-president, Thomas A. Russell.

CONTRACTS AWARDED

Berlin, Ont.
In connection with the factory which is being built on Cedar Street for Metcalfe Bros. & Company, King Street, the contract for roofing has been let to J. M. Rabb, care of Cowan Bros., 200 Victoria Street. Heating and plumbing not let.

The contract for painting in connection with the factory which is being built for Armstrong & Inrig has been let to Arthur Strome, 64 Schneider Avenue.

Cobourg, Ont.
In connection with the garage which is being built for Sparling & Reeson, the contract for structural iron has been let to Canadian Allis-Chalmers, Ltd., 212 King Street W., Toronto, the plumbing and heating to A. R. Dundas, Division Street, and carpentry to Henderson Bros., First Street.

Fort William, Ont.
Work has been started on the construction of a coal storage building for the Fort William Coal Dock Company, Mission Street. The contract for excavation and foundations has been let to the Thunder Bay Harbour Improvement Company, 27 Cumberland Street, Port Arthur. Steel frame construction, concrete foundation, corrugated iron roofing. Approximate cost, $100,000.

Hamilton, Ont.
In connection with the hotel in course of erection on King Street E. for the United Hotel Company, the contract for weather strip has been let to Kent-Garvin & Company, Catherine Street N. Painting not yet awarded.

The general, masonry, carpentry and steel work contracts for the erection of an addition to the factory of the Tallman Brass Company, Wilson Street, have been awarded to W. H. Cooper, Clyde Building. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $15,000.

Montreal, Que.
Work has been started on alterations to the store and residence of Joseph Laporte, 505 Demontigny Street. General contractors, Lacroix & Vezeau, 491 Demontigny Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $3,500.

Ottawa, Ont.
The general contract for the erection of an addition to the premises of the Capital Wire Cloth Manufacturing Company, Armstrong Street, has been awarded to D. Cuthbertson, 706 Echo Drive. Brick construction, concrete foundation, corrugated iron roofing.

The Department of Public Works, Ottawa, have let the general contract for the erection of a cereals building at the Experimental Farm to T. H. Cathcart and E. Webster, 9 Melrose Avenue.

The contract for brick work in connection with the stores in course of erection for Graham Bros., 205 Laurier Avenue, has been awarded to Robert Bolin, Bell Street. Prices are being received for plastering, painting, heating, plumbing and wiring.

Quebec, Que.
Work has been started on the erection of a warehouse and residence on Queen Street for E. Falardeau, 143 Dorchester Street. The general, masonry and carpentry contracts have been let to Jinchereau & Lamonde, Richardson Street. Brick and frame construction, stone

foundation, felt and gravel roofing. Approximate cost, $6,000.

Renfrew, Ont.

G. B. Mitchell, Jacobs Building, Montreal, has commenced the erection of a factory for Energite Explosives Company, Ltd., Power Building, 83 Craig Street West. Montreal.

The O'Brien Munitions Limited have let the contract for the supply of 30,000 feet of asbestos wall board in connection with their plant to the Asbestos Manufacturing Company, Limited, 511 St. Catherine Street W., Montreal.

Sherbrooke, Que.

In connection with the premises which are being erected on Wellington Street for the Merchants Bank, Montreal, the contract for heating and plumbing has been let to Ernest Conley, 6 Alexander Street, and the electrical work to Codere, Fils & Company, 161 Wellington Street.

St. John, N.B.

The contract for electrical work in connection with the remodelling of the premises of La Provincial Bank, Charlotte Street, has been awarded to Frank E. Jones, Prince William Street.

Toronto, Ont.

Work has been started on the erection of a garage on Melgund Road for R. Connable, 228 Balmoral Avenue. The masonry contract has been let to Witchall & Son, 156 St. Helens Avenue. Brick construction, concrete foundation, tile roofing. Approximate cost, $5,000.

In connection with the conversion of premises at 75 Queen Street W. into a theatre for Major B. Thompson, 143 Crescent Road, the contract for plastering has been awarded to A. E. Chamberlain, 103 Augusta Avenue, and the plumbing to L. Palter, 621 College Street.

Work has been started on the erection of an addition to the premises of Cutten & Foster, 302 Church Street. The contract for masonry has been let to Brown & Love, 46 Price Street, and the carpentry to T. F. Robertson, 438 Delaware Avenue. Brick construction, tar and gravel roofing. Estimated cost, $5,000.

Vancouver, B.C.

The contract for electrical work at the bank vault building in course of erection on Grandview Avenue for the Canadian Bank of Commerce, Toronto, has been let to the NePage McKenny Company, Standard Bank Building. Tenders will shortly be called for painting.

Windsor, Ont.

The general contract for remodelling stores on Ouellette Avenue for Walter T. Bartlet, Davie Building, has been awarded to Wells & Gray, Ltd., Manning House Block. Estimated cost, $5,000.

Work is progressing on alterations and improvements at premises on Sandwich Street W. for the Canadian Pacific Railway Company. General contractor, William Walker, 43 Jeanette Avenue. Approximate cost, $3,200.

Residences

Dartmouth, N. S.

Theodora Gerrard is about to erect a residence on Prince Albert Road, at an approximate cost of $3,000. Smaller trades may be let.

The Victor Wood Works, Ltd., Park Road, Amherst, are building ten residences on Stairs Street, estimated to cost $25,000. Owners are doing all work. Frame construction.

London, Ont.

Harry Hayman, 491 Ontario Street, has prepared plans for a residence, estimated to cost $4,000. Red pressed brick construction, concrete foundation, slate roofing. Work will start as soon as possible.

Montreal, Que.

J. C. Rancourt, 115 Melrose Street, has commenced the erection of a residence on Old Orchard Street. Contracts will be let for brick work, roofing, plastering, heating, plumbing and electrical work. Approximate cost, $6,000.

J. C. Frenette, 324 Breboeuf Street, is building five flats on Fabre Street. Brick construction, felt and gravel roofing. Approximate cost, $3,800.

Work has been started by E. Benoit, 2008 St. Hubert Street, on the erection of five flats, estimated to cost $6,000. Brick construction, concrete foundation, felt and gravel roofing.

Montreal West, Que.

Reid, McGregor & Reid, 513 Drummond Building, Montreal, are receiving tenders on roofing, painting, glazing, heating, plumbing and electrical work required at a residence in course of erection on Brock Avenue W.

Ottawa, Ont.

B. A. Grison, 21 Fentiman Avenue, is considering the erection of a residence on Belmont Street, estimated to cost $3,500. Stucco and brick veneer construction, concrete foundation, shingle roofing.

Work has been started by B. A. Grison, 21 Fentiman Avenue, on the erection of a residence on Fentiman Avenue. Stucco and brick veneer construction, concrete foundation, shingle roofing. Smaller trades will be let. Estimated cost, $4,000.

Walter Fryer, 5 Glen Avenue, is about to start work on the erection of a residence on Roslyn Street, estimated to cost $4,500. Contracts will probably be let for plastering, painting, heating, plumbing and electrical work. Double brick veneer construction, stone foundation, shingle roofing.

Outremont, Que.

O. Gourre & Company, 116a St. Andre Street, have commenced the erection of two residences on Rockland Avenue, estimated to cost $12,000. Brick construction, stone foundation, felt and gravel roofing.

John Mallette, 1896 St. Denis Street, has commenced the erection of three flats on Outremont Avenue. Brick construction, felt and gravel roofing. Estimated cost, $8,000.

Quebec, Que.

Cleophas Hamann, 96 St. Bernard St., is receiving quotations on all materials yet required at the residence which he is building on St. Raphael Street.

Work has been started by L. A. Robitaille, 1037 St. Valier Street, on the erection of a residence, estimated to cost $5,000. Brick and stone construction, concrete block foundation, felt and gravel roofing.

The Battlefields Commission, 2 Cook Street, have commenced the erection of a residence on Laurier Avenue. Stone construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

Work has been started by Chrysante Jobin, 198 Lockwell Street, on the erection of a residence on Cartier Avenue, estimated to cost $10,000. Brick construction, stone foundation, felt and gravel roofing.

A. Fackney, 107 St. Joachim Street, has started work on the erection of a residence on Aberdeen Street. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $7,000

Sarnia, Ont.

Postmaster J. P. Dawson has purchased a site on Julia Street for the erection of a residence. Estimated cost, $3,000.

Norman Bie, 455 Devine Street, has commenced the erection of a residence on Proctor Street. Smaller trades may be let. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

CONTRACTS AWARDED

Hamilton, Ont.

The general, carpentry and roofing contracts for the erection of a residence on Leinster Avenue for Mrs. M. A. Sinclair, 139 Hunter Street E., have been let to Samuel Easter, 25 Fairleigh Avenue, and the masonry to W. Theaker, Dundurn Street S. Brick construction, stone foundation, shingle roofing. Approximate cost, $3,500.

Montreal, Que.

Work has been started by D. Peloquin, 447 Old Orchard Street, on the erection of two flats on Marlowe Street for W. D. Boa, 552 Melrose Street. Brick construction, felt and gravel roofing. Estimated cost, $5,000.

J. Pilon, 2044 Bordeaux Street, has commenced the erection of a residence at 1090 Delorimier Street for J. B. A. Aubry. Contractor is receiving tenders on supplies and smaller trades. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

The contract for heating and plumbing at the residence which is being built on Durocher Street for Victor Guertin, 31 Sherbrooke Street W., has been let to J. St. Amand, 109 Laurier Avenue W.

L. Villani, 1173 Boyer Street, is building a number of flats on Clarke Street for Mrs. A. Villani, 1173 Boyer Street. Brick construction, felt and gravel roofing. Estimated cost, $7,000.

George Tetrault, 376 Darling Street, is building five flats on Beaujeu Street for C. Ouellette & Company, 556 Chambly Street. Estimated cost, $3,000. Brick construction, felt and gravel roofing.

The general contract for the erection of a residence on Cartier Street for the Trustees of St. John Berchmans has been awarded to T. Belanger, Valleyfield, Que. Approximate cost, $24,000.

W. H. Taylor, 2310, Gouin Boulevard, has let the general contract for the erection of two flats to Brook & Weir, 6234 Peloquin Avenue. Brick construction, felt and gravel roofing. Estimated cost, $4,500.

Work has been started on the erection of two flats on Marlowe Street for Panet

Raymond, City Hall, Westmount. The general contract has been let to Anglin's Ltd., 65 Victoria Street, the roofing to Campbell, Gilday & Company, Ltd., 793 St. Paul Street W., and the electrical work to Electric Repair & Contracting Company, Ltd , 317 Craig Street W. Approximate cost, $11,000.

Montreal West, Que.

The Montreal West Realty & Contracting Company, 347 Westminster Avenue, are building a residence on Ballantyne Street N. for M. Lombardi & Company, 345 Westminster Avenue. Approximate cost, $4,700.

W. H. Payne & Company, 62 Westminster Avenue, are building a residence on Westminster Avenue N. for G. H. Horsfall, 35 Ballantyne Street N. Brick construction, concrete foundation, asbestos roofing. Approximate cost, $7,500.

Mount Dennis, Ont.

In connection with the residence which is being erected on Rutherford Avenue by the Baskerville Building Company, the contract for masonry has been let to Smith Bros., c/o the owners, and the carpentry to N. Honsberger, Mount Dennis.

Niagara Falls, Ont.

The contract for heating at the residence in course of erection for Clark Bradley, 63 St. Clair Avenue, has been awarded to William Crawford, Buckley Avenue, the plumbing to G. H. Edwards, 21 St. Clair Avenue, and the electrical work to Carter Electric Company, Erie Avenue.

In connection with the residence which has been erected on Hiram Street by Leonard Price, 38 Monroe Park, for E. R. Dewart, Manager of the Royal Bank, Erie Avenue, the contract for carpentry has been let to F. Robertson, c/o owner, the heating and plumbing to Cole & McMurray, Park Street, and the electrical work to Niagara Electric Company, Niagara Falls Centre.

Ottawa, Ont.

The general contract for the erection of a residence on Cambridge Street and another on Aylmer Avenue for Mrs. M. Green, 121 Cambridge Street, has been let to C. S. Green, 121 Cambridge Street. Brick veneer construction, concrete foundation, shingle roofing. Estimated total cost, $6,500.

The contract for heating and plumbing at the residence erected on Frank Street by T. J. Somerville, 28 Waverley Street, has been let to E. Williams, 172 Glenora Street.

The contract for painting in connection with the residence which is being build on Fairbairn Street by the Oakland Land Company, Ltd., 1111 Bank St., has been awarded to Robert Reoch, 264 Cooper Street.

Quebec, Que.

In connection with the residence in course of erection on Seventh Street for George Langlois, 164 Third Street, the carpentry contract has been let to Ulric Cote, 125 Second Avenue, Limoilou.

The general contract for the erection of a residence for Aime Roy, 127 Commissioners Street, has been awarded to Delphe Maranda, 85 St. Agnes Street, and work has been started. Brick and frame construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

E. Breton, 75 Latourelle Street, has started work on the erection of a residence on St. Olivier Street for J. Laperriere, 15 Ste. Marie Street. Estimated cost, $4,000.

In connection with the residence which is being built on Cartier Avenue by Lavoie & Frere, 56 Jeanne d'Arc Street, the contract for roofing, heating, plumbing and electrical work has been let to P. Paradis, 236 d'Aguillon Street.

East & Masson, 62 St. Nazaire Street, have let the following contracts in connection with the residence which they are building on Aberdeen Street:—plastering, P. Tardif, 260 Napoleon Street; painting, Pelchat & Aubin, 182 Bayard Street; roofing, heating, plumbing and electrical work, J. E. Rouillard, 30 Maisonneuve Avenue.

The contract for masonry and plastering in connection with the residence which is being built on Cartier Avenue by Pierre Savard, 246 St. Oliver Street, has been let to A. P. A. Poulin, 144 Latourelle Street. Roofing, heating, plumbing and electrical work not yet awarded. Carpentry by owner.

The general, masonry and carpentry contracts for the erection of a residence on Maisonneuve Avenue for C. E. Bernier, 54 Clair Fontaine Street, have been let to Poudrier & Boulet, St. Francois D'Assise Street. Other trades not yet let. Frame and brick construction, stone foundation, felt and gravel roofing. Approximate cost, $5,000.

In connection with the residence built on Lockwell Street by Chrysanthe Jobin, 188 Latourelle Street, the contract for painting has been let to Pelchat & Aubin, 182 Bayard Street, and the roofing, heating, plumbing and electrical work to P. Paradis, 236 d'Aguillon St. Plastering by owner.

The contract for carpentry required at the residence in course of erection on Lafrance Street for O. A. Beriault, 108 Cartier Avenue, has been let to T. Cote, 26 Seventh Street, Limoilou.

Louis Careau, 127 Scott Street, has let the contract for roofing, heating, plumbing and electrical work at the residence which he is building on Lockwell Street to R. Chiquette, 210 Queen Street.

Sarnia, Ont.

A. McColman, 120 Mitton Street N., has commenced the erection of two residences for Stuart Ltd., Front Street. Frame construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

The general contract for the erection of a residence for A. L. Ward, 200 London Road, has been awarded to A. McColman, 120 Mitton Street W., and work has been started. Pressed brick construction, concrete foundation, shingle roofing. Estimated cost, $5,000.

Work has been started by A. McColman, 120 Mitton Street N., on the erection of two residences on Proctor Street for Norman Bie. Frame construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Toronto, Ont.

W. J. Devine, 51 Bird Avenue, has commenced the erection of a residence on Lauder Avenue, estimated to cost $6,000. Lumber will be supplied by the Canada Lumber Company, Ltd., Weston, granite block supplied by the Granite Concrete Block Company, Ltd., 1466 Yonge Street, and erected by Bentley & Steel, c/o the Company.

George Bailey, 79 MacKay Avenue, has commenced the erection of a pair of residences for J. Durham. Brick construction, shingle roofing. Smaller trades will be sub-let. Approximate cost $4,000.

In connection with the residence which has been erected at Melgund and Lyndhurst Streets for R. Connable, 228 Balmoral Avenue, the contract for carpentry has been awarded to the J. C. Scott Company, 106 River Street.

Westmount, Que.

The contract for roofing in connection with the two residences in course of erection on Grosvenor Street for H. Beaudry, 328 Sherbrooke Street E., Montreal, has been let to Campbell, Gilday & Company, Ltd., 793 St. Paul St W., Montreal, and the electrical work to Electric Repair & Contracting Company, Ltd., 317 Craig Street W., Montreal.

Wolfville, N. S.

The general contract for the erection of a residence for H. G. Perry has been awarded to the Rhodes Curry Company, Ltd., Amherst, N. S. Wood construction, stone foundation. Estimated cost, $3,000.

Power Plants, Electricity and Telephones

Berlin, Ont.

The City Council are considering the installation of an ornamental lighting system on Queen Street S. The wires will probably run in underground cable. Clerk, A. H. Millar.

Granton, Ont.

The Town Council will shortly submit a by-law providing for the installation of a hydro-electric system at an estimated cost of $3.500. Clerk, W. D. Stanley.

Hespeler, Ont.

The Town Council are considering the installation of a new transformer and nitrogen lamps for street lighting. Commissioner, Peter Jardine.

London, Ont.

The Battle Creek Toasted Corn Flake Company, Ltd., Dundas Street, contemplate the installation of electrical equipment for certain of their processes.

Seaforth, Ont.

The Seaforth Oatmeal Mills Company propose to instal equipment for operating their machinery by hydro power. Manager, H. Thompson.

Zurich, Ont.

The Hay Township Council are considering the installation of a hydro electric system, and will submit a by-law at the January election. Clerk, Fred Hess Sr , Zurich.

CONTRACTS AWARDED

Toronto, Ont.

The Torinto Hydro Electric Commission, 226 Yonge Street, have let the contract for the installation of wiring and complete equipment at the power station which is being built at Gerrard St. and Carlaw Avenue to J. E. Myers, 4 Gould Street.

Fires

Acaciaville, N. S.
Fire has totally destroyed the residence of George Havey. Loss partially insured.

Albion, Ont.
Fire has destroyed a barn owned by H. E. Downey. Loss partially covered by insurance.

Barker's Point, N.B.
The barn and residence of William Sturgeon have been destroyed by fire. Loss, about $3,000, partially insured.

Chatham Head, N. B.
Fire has entirely destroyed the residence of David Sinclair.

Denison's Mills, Que.
Fire has completely destroyed a barn owned by Sylvester A. Mastine. Loss, $5,000.

Dungannon, Ont.
The evaporator owned by John R. McNabb has been destroyed by fire. Loss, $3,000, partly covered by insurance.

Galt, Ont.
The factory of the Ontario Hair Works, Harris Street, has been damaged by fire to the extent of between $2,000 and $3,000. Loss covered by insurance.

Gibson, N. B.
The barns and residence of Robert Cochrane have been entirely destroyed by fire. Loss, about $5,000, partly insured.

Hamilton, Ont.
Fire has gutted the first, second and third floors of the premises of the F. W. Woolworth Company, Ltd., 29 King St. Loss, about $25,000.

Kenagami, Que.
Fire has destroyed a barn owned by J. Brubacher. Loss, $3,000.

Levis, Que.
Fire has destroyed the store owned by J. Paquet, 66 Commercial Street. Loss, $3,000.

Medicine Hat, Alta.
Fire has destroyed the residence of George Andrews, 11th Street. Loss, $5,000, partially covered by insurance.

Milford, Ont.
Fire has entirely destroyed the evaporator belonging to F. Dodge and H. Jarvis. Loss partially covered by insurance.

Milford, N. B.
The residence of George Cushing, Main Road, has been completely destroyed by fire.

Milton, N. S.
The paper mill of the MacLeod Pulp & Paper Company, Ltd., has been completely destroyed by fire. Loss, approximately $250,000.

Miniota, Man.
The following properties on East Main Street have been destroyed by fire:—store and residence, T. Conway; store and pool room, E. W. Ayer; carpentry shop, Biggs & Hamilton; store, A. Spencer; store, J. D. Forsyth; store, A. Manson.

North Sydney, N. S.
The residence of J. H. Plummer has been completely destroyed by fire. Loss, $20,000, covered by insurance.

Palmerston, Ont.
A barn owned by John Darroch, Lot 28, Concession 2, Minto, has been completely destroyed by fire.

Pelee Island, Ont.
The store owned by A. M. McCormack & Son has been entirely destroyed by fire. Loss, $35,000, partly covered by insurance. Owners are considering the erection of new premises.

Peterboro, Ont.
The factory of the Canadian Chicle Company, 83 George Street, has been badly damaged by fire. Machinery was not injured.

Port Colborne, Ont.
St. James Episcopal Church has been completely destroyed by fire. Rector, Rev. Dr. Smith.

Radisson, Sask.
A livery stable owned by Richard Lunn has been entirely destroyed by fire. Loss, $9,000, partially insured.

Revelstoke, B. C.
Fire has entirely destroyed the sash and door factory owned byy D. W. Abrahamson. Loss, $20,000, insurance, $10,000.

Sorel, Que.
Fire has destroyed the following properties at George and Prince Streets:—Convent de la Congregation, $100,000; Arthur Chapdelaine, business block, $40,000; O. Gianotsos, residence, $4,000; E. Gauthier, residence and store, $4,000; J. Cardin, residence and store, $8,000; S. Goraib, store, $5,000; L. P. Paquin, store, $4,000; C. Robitaille, residence, $9,000. All parties intend to rebuild.

St. Thomas, Ont.
The barns owned by Henry Freeman, Town Line, have been completely destroyed by fire. Loss, $5,000, insurance small.

Sudbury, Ont.
Fire has destroyed a residence on the Copper Cliff Road, owned by Napolino Govanni, Creighton, Ont. Loss covered by insurance.

Woodstock, N. B.
The livery stable of Maxon Bros. has been totally destroyed by fire. Loss is partially insured.

Toronto, Ont.
The factory of the B. F. Harvey Company, 938 Dundas Street, has been damaged by fire to the extent of about $8,000.

The residence at 24 Summerhill Ave., owned by D. M. Robertson, as been destroyed by fire. Loss, $4,000, fully covered by insurance.

Yarmouth, N. S.
Fire has destroyed a residence on Pleasant Street, the property of the Estate of James Burrill. Loss, about $15,000, insurance small.

Miscellaneous

Eden, Ont.
E. Ketchabaw is in the market for woodworking machinery.

Edmonton, Ont.
A by-law has been carried providing for the granting of a franchise to the City of Edmonton & Northern Alberta Gas & Development Company. Work will probably start soon on the construction of a pipe line, etc.

London, Ont.
The City Engineer, H. A. Brazier, will receive tenders until November 26th for about 1,700 feet of handrailing and cement coping for the breakwater.

The Car-Bex Brick Company, Ltd., are in the market for one rotary kiln and material for a shaft kiln. Manager C. S. Parker.

Manitowaning, Ont.
Neil McMartin, contractor, is receiving prices, catalogues and other information with reference to brick, cement, hollow tile, hot air furnaces, sound deadening felt paper, slate blackboards.

Quebec, Que.
Tenders are being received by G. B. Mitchell, Jacobs Building, Montreal, for millwork, roofing and tile work required in connection with the pump and power house at the Government Dry Dock.

CONTRACTS AWARDED

Brantford, Ont.
The general contract for the reconstruction of the dam and abutments has been let by the City Council to A. J. Cromar, 484 Colborne Street. Estimated cost, $4,660. Concrete construction.

Leamington, Ont.
The Town Council have let the contract for the supply of two 110 h.p. boilers to E. Leonard & Sons, York Street, London.

Sherbrooke, Que.
The contract for gas machinery required in the construction of a gas plant for the City Council has been let to the Western Gas Construction Company, Fort Wayne, Ind., and for gas holders to the Jenckes Machine Company, Sherbrooke. Report previously published is incorrect.

Two-Foot Water Head Straightens Distorted Soo Lock Gate

Injury to the north leaf of the tower operating gate of the third lock at Sault Ste. Marie put the lock out of commission for 41 hours, from 3 a.m. to 8 p.m., October 19.

When the leaf was being closed it was caught by the current running out of the lock and carried along to the sill, which it struck with such force as to spring the top of the gate, putting the toe post about a foot out of plumb. To make certain that no other damage had been done, the lock chamber was pumped out, permitting thorough examination. After attempts to straighten the leaf by the use of jacks and turnbuckles had proved unsuccessful, water was again let into the chamber, and after mitering the two leaves at the top the water was allowed to come up on the gate. Under about 2 ft. of head the distorted leaf straightened and mitered, so that there was practically no leak at the toe, though there was doubtless some along the sill. When not under pressure, the toe post is still 5 or 6 inches out of the vertical, but the gate is operating successfully. After the close of navigation such repairs will be made as seem necessary.

Tenders and For Sale Department

Debentures For Sale

Bids will be received by the undersigned until January 17, 1916, for $130,000 debentures, being $80,000 for construction of sewers and waterworks, and $50,000 for construction and equipment of an electric-light system in the town of The Pas, Manitoba.

Duration—20 years, payable at end of term.

Rate—5 per cent. per annum, payable yearly, on the second day of August. Coupons attached.

Date of debentures August 2, 1915.

Assessment $2,482,670.

Rate of taxation—general, 11 2/10 mills; school, 3 mills; debentures, 5 mills.

Debenture debt (this issue included)—$250,000.

The above issue is guaranteed as to principal and interest by the Provincial Government.

H. H. ELLIOTT,
Town Clerk.

47-52

Tender for School Addition

Sealed bulk tenders addressed to the undersigned will be received up to one o'clock p.m. on **Monday, December 20th, 1915**, for the several trades required in the erection of addition,, and alteration to school building at Elmvale.

Plans and specifications can be seen at the office of The Contract Record, Toronto, at the office of the architect, John Wilson, Collingwood, or at the office of the undersigned at Elmvale.

All tenders must be accompanied by marked cheque made payable to the Secretary-Treasurer of School Section No. 5 Flos, for five per cent. of the amount of tender.

The lowest or any tender not necessarily accepted.

W. J. McGUIRE,
Secretary-Treasurer,
S. S. No. 5 Flos,
Elmvale, Ont.

47-50

Tenders for Mechanical Mixing Apparatus

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to noon on **Tuesday, December 7th, 1915**, for the supply and erection of a mechanical mixing apparatus for the High Level Chlorination Plant, Wilton Avenue and Don River; also the supply and erection of a mechanical mixing apparatus for the Low Level Chlorination Plant, Eastern Avenue and Don River.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 6, City Hall. Tenderers must comply strictly with conditions of City By-law as to deposits and sureties, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

47

Greater Winnipeg Water District

TENDERS

for Bronze Castings and for Brass Pipe and Fittings for Venturi Meter

Sealed tenders addressed to the Commissioners of the Greater Winnipeg Water District will be received up to noon of **December 15th, 1915**, for the supply of miscellaneous Bronze Castings, Brass Piping, etc., which enter into the construction of a Venturi Meter.

Specifications and form of tender may be obtained at the office of the District on and after November **23rd, 1915.**

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners.

901 Boyd Building,
Winnipeg, Man.
November 23rd, 1915.

47-49

WANTED

Clam Steel Bucket, one yard. Specify weight, condition, type and price. Box 262, Contract Record, Toronto. 46-47

A Real Opportunity to Purchase A Going Concern

Foundry and Machinery Establishment. Splendidly located and readily convertible for shell making. Address Box 263, Contract Record, Toronto. 46-48

Late News Items

Aylmer, Ont.

Fire has totally destroyed the Victoria Hotel, owned by the Bank of Ottawa, 116 Wellington Street, Ottawa. Loss, $30,000, insurance $20,000.

Lyall, Man.

Work is progressing on the erection of a school for the Prosperity School District. The contract for some stone work has been let to the Wallace Sandstone Quarries, Ltd, Electric Railway Chambers, Winnipeg. Approximate cost, $12,000.

Muskoka Falls, Ont.

The Ontario Hydro Electric Power Commission are establishing a plant for the development of 1,000 h.p. Chief Engineer, F. A. Gaby, Continental Life Building, Toronto.

Ottawa, Ont.

In connection with the residence in course of erection on Fairbairn Street for W. J. Spratt, 157 Sunnyside Avenue, the contract for painting has been let to Robert Reoch, 264 Cooper Street, and the plumbing to J. B. Gervin, 1095 Bank Street. Approximate cost, $5,500.

The general contract for the erection of a residence for H. L. Morrison, 15 Ossington Avenue, has been awarded to Bower Bros., 133 Hopewell Avenue. Prices are being received for plastering, painting, heating, plumbing and electrical work. Double brick veneer construction, stone foundation, shingle roofing. Approximate cost, $7,000.

In connection with the residence which is being built on Brighton Street for H. Puddicombe, 410 Queen Street, the contract for heating and plumbing has been let to H. A. Knox, 346 Elgin Street, and the electrical work to T. E. Hopson, 217 Slater Street.

Bower Bros., 133 Hopewell Avenue, have commenced the erection of a residence on Ossington Avenue, estimated to cost $6,500. Contracts will be let for plastering, painting, heating, plumbing and electrical work. Double brick veneer construction, stone foundation, shingle roofing.

Tilbury, Ont.

Fire has destroyed a business block on Queen Street, owned by Forbes Bros. Loss on building and contents, approximately $11,000, partially covered by insurance.

Toronto, Ont.

Work has been started on the erection of a residence at 416 Indian Road for Miss Strachan, c/o Eden Smith & Son, architects, 199 Yonge Street. The contract for masonry has been let to F. & A. E. Ham, 83 Salem Avenue. Approximate cost, $6,000.

The Board of Control will receive tenders until December 7th for the supply and erection of mechanical mixing apparatus at the High and Low Level Chlorination Plants. Plans and specifications at Room 6, City Hall.

Walkerville, Ont.

In connection with the residence in course of erection on Windermere Road for C. M. Bennett, 22 Assumption Street, Windsor, the masonry contract has been awarded to P. Blonde, 222 Windermere Road, the carpentry and roofing to the Williamson Construction Company, Walker Road, and the plastering to John Reid, 158 Goyeau Street, Windsor.

Winnipeg, Man.

The Board of Control have let the contract for laying a watermain on Wellington Crescent to the Dominion Construction Company, 290 Selkirk Avenue.

Removing 258,000 tons of sediment from the water of St. Louis in 1914 cost 22½ cents per inhabitant. In the classification process, which was used prior to the construction of the filters, 13,660 tons of lime and 6,770 tons of sulphate of iron were applied to 34,656 million gallons of water. E. E. Wall in his annual report pictures it for the layman as follows: "Had it been loaded on ordinary coal cars, they would have made a train 112 miles long."

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Why Are So Many of Our Fine Public Buildings Built with Foreign Stone?

Any country's wealth is measured by what it can produce, rather than by what it can consume. And the first requisite is quality. If we as a nation hope to become known outside our own borders for our manufactured products, it must be primarily because their quality compares with that of competing products. The cry so often heard of "Made in Canada" is, without doubt, in the main correct, though its significance is often misinterpreted. No manufacturer is justified in trading on public sentiment to the extent of demanding unfair or uncompetitive prices. No citizen is justified in disregarding his own interests by buying home products unless he feels that he is getting as much value for his money as can reasonably be expected. If, in the last analysis, the cry "Made in Canada" is going to be of any real use to us as a nation, it must be because this slogan stands for honest quality. Even at home sentiment will come second, while outside our own borders it will naturally be against us. Quality and price will be the only tests.

* * *

There are many well-known instances that might be quoted here where the Canadian manufacturer has worked this "Made in Canada" cry for his own ends—to raise the price of his goods or reduce their quality. At least, that is the story one often hears from the man on the street. As the result of this belief the public are often lukewarm as to whether they buy home-made articles or not. This attitude is unfortunate—at least in so far as it affects lines of trade that are not guilty of any offence, and we believe there are many. One of these is the Canadian quarry trade. We have plenty of ideal building stone in Canada, and yet a very large percentage of our public buildings are built of stone imported from the United States. Why is this? So far as we can learn, it is not on account of the price. Apparently Canadian stone can be laid down in Toronto, say, at prices which compare favorably with Indiana or Cleveland stone, but in spite of this the latter stone is specified. We believe the public sentiment is entirely favorable to the use of Canadian quarries. It would give us much more pride in our fine public buildings to be able to point to them as examples of Canadian stones. Why are we deprived of this privilege?

* * *

The one excuse that has been offered is—delivery. Builders are afraid their work will be held up. Canadian quarries operate, they say, only according to demand, whereas United States quarries store up large quantities ready for immediate shipment. This may be true, but if so it is a matter easily remedied. The quarry companies naturally hesitate because they know the "habit" of our Canadian building authorities is against them.

Right here seems to be a splendid opportunity for a practical application of the "Made in Canada" watchword. Let our purchasing authorities—government, municipal, school board, and so on—give the Canadian quarry companies a reasonable assurance that their claims will receive favorable, and even lenient, consideration. We have reason to believe the response will be satisfactory, and that the danger of poor delivery will be removed. Other things being equal, let us at least make the outside of our public buildings indicative of our nationality.

On the face of it, does it seem reasonable that we can teach our children loyalty to and respect for the Dominion of Canada and the British Empire while they are surrounded by walls constructed of foreign materials? We should like to have expressions of opinion from our readers on this question.

Toronto Branch C. S. C. E. Discusses Aviation

Mr. J. A. McCurdy, B.A.Sc., managing-director of the Curtiss Aeroplanes and Motors Company, delivered a very interesting address on Aviation before the Toronto branch of the Canadian Society of Civil Engineers on November 22. Mr. McCurdy is associated with the Curtiss Aviation School at Toronto, which is training Canadian aviators for service with the Allies.

Aviation is distinctly divided into two fields—heavier than air, and lighter than air, machines. The latter was originally the more thought of, and consists of craft such as the dirigibles, balloons, and Zeppelins. This branch of aviation has been very largely developed by Germany, but has been largely supplanted by the heavier than air craft in France, Great Britain and America.

While air machines have occupied the mind of man for an indefinite period, it was only towards the end of the nineteenth century that any scientific investigation was made in the art. In 1900, Wright Brothers, profiting by experiments that had already been carried out, added some valuable discoveries to the science of aviation, and in 1903 made the first flight in a power-driven machine. In 1904 the French became interested in aviation, and have made more rapid progress along that line than any other nation. In 1907 an aviation association was formed in Nova Scotia, which included Messrs. Alexander G. Bell, Casey Baldwin, Glen Curtiss, and J. A. D. McCurdy. During the winter of 1908-1909 members of this association made the first flight ever accomplished in the British Empire. At the present time, after a lot of experimenting, it is found that the biplane, with an enclosed streamline body and propellers in front, is most in favor, being much faster than the monoplane—a speed of eighty to ninety mils an hour having been obtained. This, according to Mr. McCurdy, is a branch of science in which Canada should take a foremost place, having already sent sixty-eight pilots to the front, and at the present time having approximately two hundred and fifty in training. The speaker expressed his earnest sincerity that Canada would appreciate her opportunity and develop this national asset.

Montreal Gets Good Roads Convention

As already intimated in the Contract Record, Montreal has again been selected for the third convention of the Dominion Good Roads Association, to be held on March 6 to 10, inclusive. As in previous years, there will be exhibits of government models of various types of roads, and samples of materials used for thoroughfares. It is also proposed to exhibit road-making machinery, equipment, etc. Naturally, the main portion of the papers will deal with good roads, but the question of town planning and municipal improvements will also be discussed. The London County Council has been invited to send a delegate to the convention, while in addition to the representatives of various societies directly interested in the making and up-keep of good roads, it is planned to invite members of agricultural associations. The following are the officers of the Dominion Good Roads Association: Hon. Presidents, Mr. W. A. McLean, Commissioner of Highways for Ontario, and Mr. U. H. Dandurand, Montreal; president, Mr. B. Michaud, Deputy Minister of Roads, Province of Quebec; vice-president, Mr. O. Hezzelwood, president of the Canadian Automobile Association; committee, Mr. R. S. Henderson, president of the Manitoba Good Roads Association; Ald. R. J. Shore, of Winnipeg; Lieut.-Col. W. N. Ponton, president of the Associated Boards of Trade, Belleville, Ont.; Mr. Howard W. Pillow, president of the Automobile Club of Canada; and Mr. J. A. Sanderson, honorary president of the Ontario Good Roads Association and of the Dairymen's Association of Eastern Ontario; secretary, Mr. G. A. McNamee.

Record Construction on Sewer Job

By mounting triangular 3-yd. boxes on two ordinary wagon bodies and utilizing a 6-yd. motor truck, a Chicago contractor was able to complete 2½ blocks of 5½-ft. brick sewer in five days and to keep the street clean while the work was being done. The following detailed information taken from the Engineering Record will be of interest to the contractor. The top of the box is 10 ft. above ground and the floor forms a chute starting at the top on the outside and extending at a 45-deg. angle past the side of the wagon for a distance of about 3 ft. This overhang is sufficient to permit discharging the material into the trench and still keep the wheels of the wagon from crumbling the edge of the trench. The discharge gate consists of a door, hinged at the top, controlled by a lever beside the driver's seat.

The sewer is part of the readjustment made necessary by reason of the new Union Station. It is a 5½-ft. circular brick sewer 2½ blocks long on Canal Street alongside the Chicago & North Western Railway station. The first half block was excavated in tunnel by hand on account of railroad tracks. The remainder was excavated by a revolving shovel with a ⅝-yd. dipper on a dipper handle 30 ft. long. The trench was from 14 to 20 ft. deep and 7½ ft. wide. The tough blue clay with occasional boulders required little bracing. The average advance was from 60 to 85 ft. per 10-hr. day. The shovel worked on a set of six 3 x 24-ft. platforms straddling the trench. The platforms consisted of two 12 x 12-in. timbers armored on the inside by a ¼-in. plate. These timbers were separated by a 14-ft. 12 x 12-in. stick with the centre cut away for the insertion of steel straps, on which was hung a ring for handling.

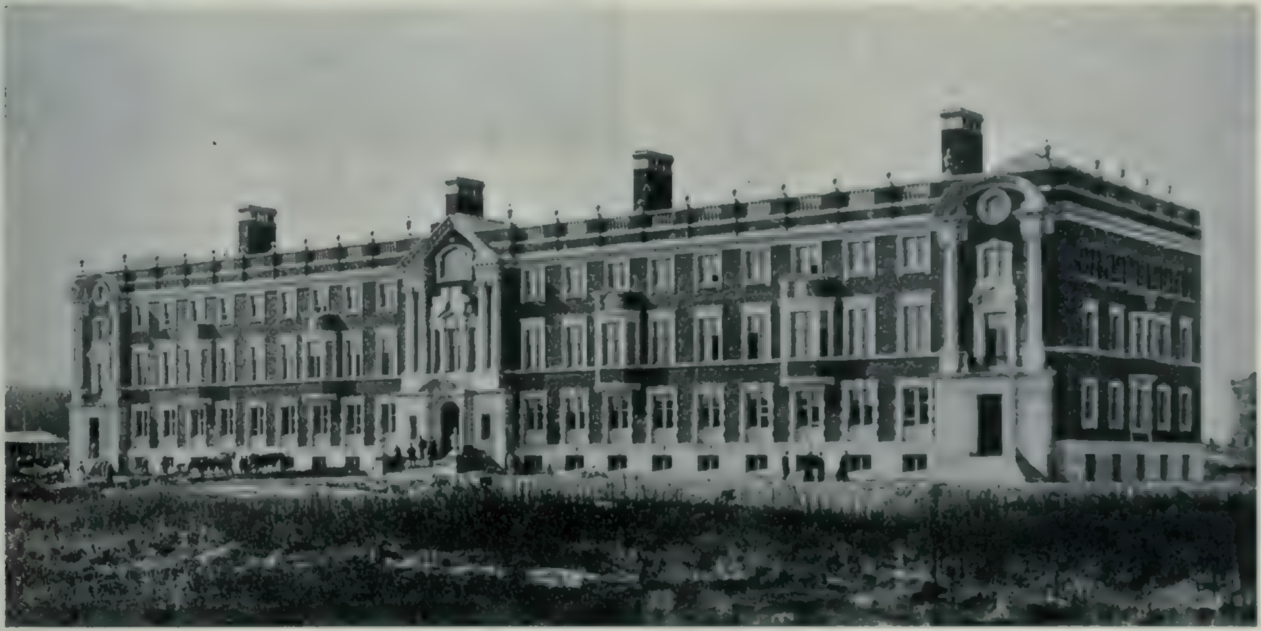
In addition to the shovel crew, there were four men in the trench shaping the forms, handling braces and assisting in moving the platform forward. Two men tamped the backfill. The two brick layers were assisted by three passers and one man carrying mortar. With this crew the work was completed between Aug. 2 and 12, five days being lost on account of rain.

The Third Canadian and International Good Roads Convention will be held in Montreal in March next. The first congress was held in Montreal, and the second in Toronto.

Central Unit of University of Alberta

The provincial seat of learning a handsome structure—Will be added to as development demands—Separate building for power house

COMMENCED in May, 1914, the central unit of the University of Alberta building scheme has just been completed at Edmonton by the contractors, the Geo. A. Fuller Company, Limited, Montreal, from plans by Messrs. Nobbs and Hyde, architects, Montreal. It is known as the Arts Building, and consists of a main building, with an assembly hall at the west end, together with separate structures for laboratories and power house. The style of architecture is Free British Classic. The main building has four storeys, and is 300 ft. long and 70 feet wide, while the assembly hall is 100 feet long and 60 feet wide.



University of Alberta, Edmonton, Arts Building - Front view.

The exterior of the main building has a base of granite, with walls of Tregillus brick and trimmings of Indiana limestone. The central door is flanked by two columns, over which is a circular pediment with a cartouche, on which are carved the arms of the province. Between the third and fourth floors on the oriel windows four carved panels represent Philosophy, Music, History, and Mathematics.

The basement floor, in red and grey brick, contains a stack-room for books, a book receiving room, book store, a printing department, elementary physics laboratory, and a spare laboratory. There are also men's and women's dressing rooms. This floor is continued under the assembly hall, where are the band room, storage room, ventilation system, etc., with an entrance for general delivery.

The first floor is the main one, and provides accommodation for the public activities of the students. The central entrance is, like those at the ends, reached by flights of marble steps. The entrance hall has walls in semi-glazed terra-cotta, the floors being of marble. From this hall there is a wide passage, with a barrol vault, which leads directly to the assembly hall. To the right and left are wide corridors, midway through the building. Opening off the hallway to the north is the common room of the students, this being one of the apartments which are panelled in oak. To the west are the lecture room and laboratory of the advanced physics department. At the extreme end of the south side are the offices of the University extension department and the women's common room. On the north are four class rooms and a lecture room with offices. Here, as in the class rooms on the floors above, the class and lecture rooms are constructed on the one, two, and three unit system, which will permit of the hollow-tile curtain partitions being removed and any of the rooms enlarged to meet the requirements of the future. The lecture rooms throughout are provided with the stadium style of seating, which ensures students an uninterrupted view of the platform and demonstration boards.

Entrance to the floors above is gained by two wide stairways, while at the other entrances a single flight leads to the upper portion of the building. These staircases are of ornamental ironwork, fitted with oak handrails, with steps of slate and marble.

The assembly hall has a seating capacity of one thousand, and ample provision is made for arrival and departure by means of a large crush lobby and side exits. The hall is extremely well lighted, there being twelve large windows on the north and south sides. The ceiling is barrol vaulted with ornamental plaster ribs. The forced-air ventilating system used throughout the building has been artistically handled in the hall, the draft vents in the ceiling being in interlaced rope designs. At the western end is a large stage with dressing rooms behind; a removable orchestra rail is to be built, together with a convertible system of stage foot-lighting. The gallery, which extends entirely round the hall from one side of the stage to the other, is without pillar support, and therefore gives an unobstructed view.

The administration offices are situated on the next floor. The faculty room is placed directly over the main entrance; it is oval in form, with oak panelling on the walls, and a striking parquet floor design. Here the sessions of the University Senate will be held, as well as the meetings of the faculty. Leading off this room are the private office of the President of the University and the board room. Just outside and facing on the corridor is the ante-room and office of the President's secretary. Across the corridor is the general administration room, incorporating the offices of the bursar and registrar. At the extreme ends of this section of the building are placed suites of offices for the faculty, and between are class rooms and lecture rooms and the laboratory of the psychology department. From the central main hallway on this floor access is obtained to the balconies of the assembly hall.

Laboratories form the chief accommodation on the third floor. These include, on the south side, advanced and elementary chemistry rooms, with the accompanying departments of geology and biology. Along the front of the building is a large room for elementary chemistry, the fume closets being lined with white tile. On the other side of the corridor are the chemistry lecture and preparation rooms, while running across the extreme end is the advanced chemistry laboratory. Above this is a fourth or mezzanine floor room for microscopic and other work. Offices for the Provincial Health Board, with a laboratory, are provided in the front of the building, overlooking the main entrance. At the north end in the large room along the front is centred the petrography laboratory, and adjoining it is the geology lecture room. Crossing the corridor there is a large laboratory for mineralogical purposes, with a class room of the biological department. Across the extreme end is the elementary biology laboratory, this being directly below a sky-lighted laboratory for advanced biology on the mezzanine floor. All the laboratories on the third floor are fitted with an elaborate system of sky-lighting with a triangle fronting to the north, rendering them admirably suitable for experimental purposes.

The first and second floors are finished in terracotta and passageways of tiling; the third storey is fitted with cork linoleum on cement. This style of construction is carried out in detail throughout the entire building.

Separate from the main building, and situated a short distance from it on the south side, are two laboratories, so constructed as to permit of future additions. They are built of steel, brick, and concrete. The civil, mining, and mechanical engineering departments are to be placed in one of the buildings, the offices and draughting rooms of this faculty being situated on the north side. Along the south side is the workshop of the department, with its complement of demonstration machines and the travelling crane which will move the machinery from place to place. There will also be a suite of laboratories for industrial purposes, in which will be carried out the commercial tests of fire clays and materials of this nature. The power house is in the rear section of the other laboratory. The plans provide for an enlarged power house to be eventually constructed on another site, but the existing structure will serve for present needs. In this particular building will later be centred exclusively the department of mechanical engineering; it is now, however, required to furnish class rooms and laboratories for such other departments as those of physiology, anatomy, bio-chemistry, and bacteriology. From the power plant engine room there is a tunnel to the basement of the Arts Building to supply heat and power to the main building.

Atlantic Terra Cotta in gray color, matching the stone of the lower storeys, was used for the gable copings, the main coping and finals and the balustrade of the fourth storey. This use of terra cotta, it is claimed, effected a considerable saving over the cost of stone.

View of Alberta Arts Building—Rear view.

The general contractors for the Arts Building were the Geo. A. Fuller Company, Limited, Read Building, Montreal. The following firms supplied the material:—Fire brick, Tregillus Clay Brick Company, Calgary; inside terra-cotta, Leeds Fireclay Company, Leeds, England; outside terra-cotta, Atlantic Terra Cotta Company, Rocky Hill, N. J.; iron work, Alberta Ornamental Iron Company, Redcliffe, Alta.; limestone, Hoosier Cut Stone Company, Bedford, Ind.; granite, Laurentian Granite Company, Montreal; painting and glazing, Taylor Painting & Decorating Company, Winnipeg; millwork, Knight Bros. Company, Limited, Burks Falls, Ont.; millwork in special rooms, Geo. Roberts, 79 Lagauchetiere Street West, Montreal; hardware, Jas. Walker Hardware Company, Limited. Montreal; Hope sashes, David McGill, 320 Lagauchetiere Street West, Montreal; and brick, Acme Brick Company, Limited, Calgary. In addition to these, the following sub-contracts were let by the architects: heating and plumbing, Ross Bros., Edmonton; electrical work, Burnham Frith, Edmonton. The general contractors for the laboratories were Reid, McDonald and Brewster, Edmonton, while the plumbing was done by McKnight & Foote, and the electric work by Bert Perry.

A series of interesting facts bearing on the steel and iron industry of Canada were given in a paper prepared by Col. Thomas Cantley, president of the Nova Scotia Steel and Coal Company, and read before the members of the Montreal Metallurgical Society at Montreal by his son, Major Cantley, of the same company. According to Col. Cantley, Canada received one hundred and sixty million dollars' worth of war orders up to the end of June last, and during the first nine months of the present year four million shells were sent out of Canada. Col. Cantley estimated that during the next fifteen months Canada would export between two hundred million and three hundred million dollars' worth of war materials, the greater part of which would be shells.

Engineering Features of Cedars Plant

Further details of constructional design and hydraulic equipment of Canada's most modern hydro-electric development.

MR. Julian C. Smith's paper before the Canadian Society of Civil Engineers, treating of the general hydraulic design, hydraulic machinery, auxiliary equipment, and some phases of the construction work of the Cedars Rapids Manufacturing and Power Company's plant, contains a quantity of interesting information not before made public. For example, in the precautions taken to avoid ice trouble wonderful ingenuity has been shown, and advantage has apparently been taken of every natural condition. The general direction of the water as it enters the forebay has been arranged as nearly as possible so that it is at right angles to the main flow of the River St. Lawrence. In addition to this a series of cribs has been constructed from the bank of the river and extending downstream more or less at right angles to the current, with the idea of deflecting the main current of the river further out into the river and thereby reducing the probability of floating material entering the canal. It was argued that if ice of various sorts could be driven out into the swift water of the main part of the stream the amount taken into the canal would be very much reduced.

As additional precaution against ice troubles two sets of openings through the canal bank are provided —one near the upper end of the canal, consisting of seventeen openings each having a free span of 15 feet. These openings are normally closed with stoplogs with the crest of the concrete still about 10 feet below the lowest water. A similar set of openings, but not quite so long, is provided immedately above the power house. The idea in connection with these openings is that by adjusting the stoplogs, so as to provide an overflow of about two feet, a high surface velocity can be obtained, particularly in the neighborhood of the spillway itself, and that ice guided in this direction by properly located booms will flow out of the canal through these openings.

Through the power house itself, which will ultimately be 1,200 feet long, a number of openings are being provided—three openings in the present structure, which is 700 feet long. These openings are to serve the purpose of removing ice or other material which may collect before the power house, without the necessity of passing this material clear across the full length of the building.

Thrust Bearings

The paper describes in a very interesting manner the design of thrust bearing finally adopted, and the reasons therefor. The following quotations are taken direct from Mr. Smith's paper:—

"In the sub-structure as constructed provision was made for ten units, each of about 10,800 h.p., and three exciters or auxiliary units, each of 1,500 h.p.

"Before the design could be developed completely, the type of thrust bearing to be used in case the vertical unit was chosen had to be decided upon.

"There are several types of thrust bearings now in common use in power developments, amongst them being the oil pressure bearing, the roller bearing, and the Kingsbury bearing.

"The oil pressure bearing is familiar to you all, consisting as it does of an oil film maintained by pumps between a stationary plate and a rotating plate.

"The roller bearing has been developed and is in common use on small units. A few installations have been made on large units, and at the time this plant was designed, some three years ago, a careful study was made of the roller bearing.

"The roller bearing had a number of very good points, inasmuch as it was a positive support to the rotating parts, and the lubricating system only needed to be sufficient to circulate and cool the oil. Some difficulties had been experienced in a few plants with roller bearings, particularly on account of the difficulties in obtaining suitable steel plates to serve as a bearing surface against which the rollers operate. It seemed to be an extremely difficult thing to obtain a piece of steel of uniform hardness, and which would not deflect or warp when the temperature rose.

The Kingsbury Bearing

"The third type of bearing, and the one finally chosen, is a new design, and one which has rapidly come into prominence in the last few years. This bearing was invented and manufactured by Albert Kingsbury, of Pittsburgh, and while having some of the advantages of the roller bearing, possesses advantages of its own.

"It has certain disadvantages also, but these disadvantages seemed to have been met at the time we ordered the bearings, and the performance of the bearings has borne out the wisdom of deciding to adopt that style of apparatus.

"The Kingsbury bearing depends, like the oil thrust bearing, on the oil film maintained between a rotating plate and a fixed surface. The fixed surface, however, is not a continuous plate, but is made up of a number of sectors, each independently supported and each free to rock slightly. By this device the oil is entrained between the fixed plate and the rotating plate on account of the viscosity of the oil, and an oil film established as soon as the machine has made a part of a revolution.

"After the machine gets to full speed, the rotating part rises about one or two thousandths of an inch on the oil film, and after that the friction is reduced to a very low amount, the losses in this bearing being considerably less than in the roller bearings.

"The weak part in connection with the Kingsbury bearing is at the time when the machines come to rest. At that time the oil film is squeezed out and the machine starts practically metal to metal.

"By the use of a very hard babbit, containing a high percentage of tin and a carefully machined and scraped surface, no injurious results take place, and with due precautions in starting and stopping these machines the results obtained have been very satisfactory.

"Having decided on the use of a thrust bearing of the type mentioned above, it was then decided to place the thrust bearing on the top of the machine in order to make the bearing accessible, and to reduce the thickness of concrete required under the machine.

"If a thrust bearing of any type had been put between the water-wheel and the generator, it would have been necessary to have provided a tunnel passage for these bearings to make them accessible, and therefore the floor level of the power house would necessarily have been changed.

"In order to carry the thrust bearing on the generator, cast-iron brackets were designed by the waterwheel company, and calculations made not only as regards their strength but particularly as regards the deflection.

"The rigidity of this construction was one of the main reasons why this design was finally adopted, as it was deemed necessary to provide a design which would give as little vibration as possible.

"This can readily be understood when the dimensions of the oil film, that is about one to two thousandths of an inch, are mentioned."

Another section of Mr. Smith's paper gives the following construction data,—

"Work with one steam shovel was commenced towards the end of 1912. The crib work was finished, pumps were installed, and most of the work of unwatering and the arrangement of the construction plant was designed and largely completed in 1912, and the spring of 1913. In the spring of 1913 a contract was entered into with Fraser, Bruce & Company by which these contractors undertook the excavation, concrete work in the power house, and in general the main features of the work except the superstructure of the power house, and transformer house, and the installation of the apparatus in the power house. During 1913 a considerable amount of the south bank was completed, and work commenced on that part of the south bank extending across the rapids to the Isle aux Vaches.

"During the fall of 1913, and in 1914, eight steam shovels were at work, twenty-eight locomotives, and two hundred 6-yard and thirty-six 12-yard cars. The performance of the steam shovels varied tremendously, as would be expected in different classes of material. When excavating clay at the lower end of the canal near the power house the No. 1 shovel made the best record, taking out about 47,000 cubic yards place measurement of material in the day shift, and about 21,000 cubic yards in the night shift, in a month. When excavating boulders which formed the original bed of the river, these boulders being more or less cemented into place, but not requiring drilling, one shovel took out about 20,000 yards in one month.

"When excavating rock which required to be drilled and blasted, the shovel performance was about 11,000 cubic yards per month per shovel.

"It can be readily understood from the description which has been made, that the construction plant for handling this work was in itself very extensive. The engineering features involved in the design and the operation of this plant were quite a job in themselves. Outside of the steam shovel and transportation plant above mentioned, two air compressor plants were installed, each plant having an aggregate capacity of 2,500 cubic feet of free air per minute when in operation.

"A machine shop, carpenter shop, and blacksmith's shop and various other small shops were required for the operation of this construction plant. Electric power was used from the nearby station of the Montreal Light, Heat & Power Company, the maximum used being in 1914, about 2,500 h.p.

"The construction plant, including what belonged to the Cedars company, and to the contractors, cost in excess of $600,000. This figure is mentioned as showing the very extensive amount of plant required for a job of this nature. Extensive temporary buildings were also required, approximately $85,000 being expended for this work.

"The first concrete was in place in the power house in August, 1913, and the power house concrete was completed in October, 1914; the total amount of concrete in the power house being 79,000 yards, plus 1,500 yards of grout. This concrete was put in at the rate of 600 cubic yards per day under best conditions."

Siphon Bridge over Bow River carries 8 ft. Water Pipe

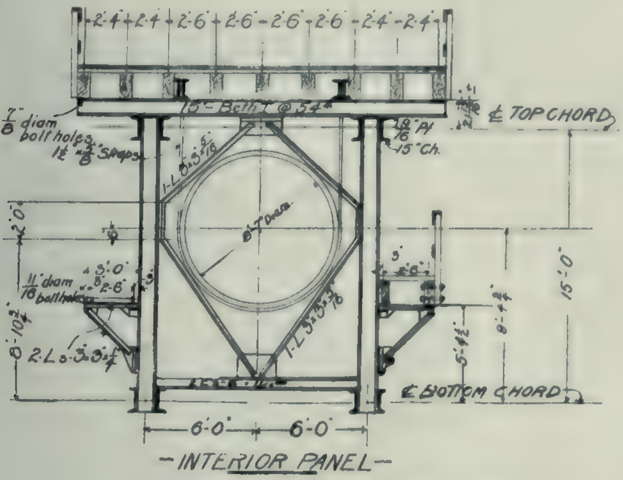
A bridge over the Bow River about seventy-five miles north of Medicine Hat, recently completed, which forms part of the large irrigation project of the Southern Alberta Land Company, Limited, presents some interesting features.

The structure consists of six 120-ft. riveted truss spans, which carry an 8-ft. wood-stave pipe line over the Bow River and also provide a 20-ft. roadway and two 3-ft. sidewalks. The truss spans are designed for carrying, at some future time, a single-track electric

Views of Bow River Bridge—Part of Southern Alberta Land Company's big irrigation system.

railway. The sidewalks are cantilevered from the trusses in such positions as to permit inspection of the pipe line, which is supported on cradles, hung from the roadway stringers by means of steel slugs.

The bridge is a part of one of the largest irrigation projects in North America, comprising 204 miles of main canal and irrigating about 250,000 acres. The wood-stave pipe line, where it crosses the Bow River, is a syphon having a total head of 193 ft. The syphon is 96 ins. in inside diameter, and is constructed of fir staves which have a finished thickness of 3⅝ ins. and are banded together with ¾-in. and ⅞-in. bands. The supporting cradles are of concrete, spaced 6 ft. on centres. The total length of the syphon is 6518.5 ft., 720 ft. of which are supported by the Bow River Bridge.



Cross Section of Bow River Siphon Bridge.

In building the bridge it was necessary to haul all materials entering into it from Suffield, Alberta, a distance of 25 miles. This town is located on the Canadian Pacific Railway and is the nearest railway station. Figure 2 is a construction view illustrating the manner of erecting the bridge. The construction of the piers and the erection of the super-structure were made exceedingly difficult by the ice gorges and by the rapidly fluctuating river stage.

The steelwork and piers were designed and erected by the Wisconsin Bridge and Iron Co., of Milwaukee. Wis. The design and erection of the timber approaches were in charge of D. W. Hays, chief engineer of the Southern Alberta Land Co., Ltd.

Record Size Concrete Floor Slab—Over 4,000 square feet area without Intermediate Supports

What is thought to be the largest free area of concrete slabs without interior supports has recently been built in San Antonio, Texas, in an addition to the Bexar County Court House. The slab measures 112 ft. 6 in. by 37 ft. 6 in. in extreme dimensions, and is supported only along the edges. There are three such slabs in the structure, which is to be used for court rooms. It was desired to keep the storey heights the same as the old court house adjoining, and at the same time to provide a room that would be large enough for court usage. In order to accomplish the purpose without sacrifice of space, the architects determined to use a flat, unobstructed slab. The floor system finally adopted was a ribbed system, with plastered ceiling below, the ribs running across the building, and carried to the wall columns by beams masked within the walls of the building. The Kahn System of Floortyle construction was used, and proved most satisfactory.

The floor system was designed for a maximum load of 175 pounds per square foot, including 75 pounds live load, and consists of reinforced concrete ribs with top slab, forming a series of small T-beams. The ribs are 17½ inches in depth from the top of the slab, which is 3½ inches thick, and are formed by parallel lines of Floortyle spaced 26 inches on centres. These Floortyle are simply corrugated sheet iron troughs, 21 inches across the open side, which is placed down. The sides are battered, so as to thicken the ribs out into the top slab, and the top serves as a form for a thin slab on top. The spacing gives a bottom width to the ribs of 5 inches. The concrete and steel in this design had a weight of 80 pounds per square foot. Forms were built over the entire area, and upon them were first laid Hy-rib, upon which the ceiling was later plastered. The rows of Floortyle were then lined up, and between them was placed the reinforcing steel, which consisted of Khan bars. Concrete was placed from an A-frame gravity chute which reached all parts of the slab area.

In designing this slab, a bending moment at the centre of 1/8 W1 was calculated, using 1 as the distance face to face of the supporting beams. The supporting beams were calculated for fully continuous action except for the end spans, which were considered as partially continued. Columns were figured without any addition for bending moment due to the deflection of such a long span slab, and were reinforced by vertical steel rods with hoop ties. The beams carried the outside wall at each storey, in addition to the floor slab. The following unit stresses were used:—steel in tension, 18,000 lbs. per sq. in.; concrete in bending, 750 lbs. per sq. in.; concrete in hooped columns, 500 lbs. per sq. in. on section inside hoops; concrete and steel combined, in shear, 140 lbs. per sq. in. The cost of this floor, including only concrete, reinforcing steel, Floortyles, Hy-rib, and forms, was 45 cents per square foot of slab area. The entire design was made in the office of the Trussed Concrete Steel Company of Texas, who also supplied the reinforcing steel, and other metal work, and who have patented the system.

Sewage Treatment and the War

When the war is over and ordinary municipal activities have been restored throughout Europe there may be some surprising realignment of sewage treatment. Necessary economies will force all the European countries engaged in the war to adopt a rational rather than an ideal sewage-treatment policy, such as has been practised in Germany for a decade or two. Partial processes, like screening and tank treatment, will doubtless be widely employed, and in many instances nothing more may be feasible for years to come. If the activated-sludge process is shown to be an economic success it bids fair to be adaptable to almost any degree of treatment and thus to find its way to all parts of the world. By the time the war is over, the possibilities of this most interesting and promising method of sewage treatment will probably be determined.—Engineering News.

Country Roads—Past, Present, and Future

Suburban and country road of future is "Concrete"—Day of Macadam is past — Municipality should finance the supply of material.

By J. W. Astley

THE problem of deciding upon the best kind of road, having in mind not only present but future requirements, is a familiar one. Engineers make the mistake of paying too much attention to what is being done in other countries. I refer to it as a mistake because our distances are greater, our climatic conditions dissimilar from those experienced elsewhere, our labour and traffic conditions different, and moreover we have to do with different aspects of the question of raising money. Under these circumstances we must improve as we go along, and endeavour to anticipate changes in traffic. Before starting to outline what we should endeavour to aim at I will give a short review of my experience. This may be helpful as showing that improvements in road-building have kept pace with the changing requirements, even though the progress has been small.

My first experience dates back forty years. At that time country roads were corduroy or dirt, and nearly all of them were constructed by what was known as "statute labour." This means that by statute so many days' work had to be done. What constituted a day's work, however, was left pretty much to the individual. During the same period certain roads were made by the military department. In most cases these military roads were well drained, and in each locality the best material available and the best means of handling it were taken advantage of. In the latter respect the construction was worthy of note, but otherwise the roads would not suit present-day requirements. For many years these statute labour dirt roads were made to answer the purpose simply because money was scarce and because produce was generally taken over the roads in the winter. Moreover, time was not as valuable then as it is now.

Gravel Roads Stand the Test of Time

I know of some short stretches of gravel roads laid forty years ago which stand to-day as a monument to the men who acted as pathmasters—this being the name given at that time to the official in charge of the work. From that time on macadam roads were built. If these were built of some hard rock they gave considerable satisfaction (until the advent of the automobile and fast-moving truck), and if properly laid and kept in repair they proved valuable as a foundation for some asphalt wearing surface.

Twenty and thirty years ago many concrete pavements and roads were also built, but the majority were laid badly and gave poor satisfaction. Owing to defects in construction, they did not provide as good a foundation for an improved surface as an old macadam which had been well built and maintained.

During the last few years considerable thought has been given to various classes of roads. This is due largely to the fact that we realize that the fast-travelling automobile and truck have come to stay. This traffic will give us more to think about in the future, and we must prepare ourselves accordingly. Heavier trucks and heavier loads will have to be carried from the farm to the elevator, and from the larger towns to the smaller towns and villages. Much of the transportation will be by road in place of by rail.

Having had a glimpse of the past, we will consider the present and the future as regards suburban and country roads. We need not consider city streets, as they are generally looked after by competent engineers.

Now, as dirt roads will be pre-eminent for many years, we will discuss them first. In the first place, if it is possible, all road-building should be controlled by some central authority in charge of a certain well-defined district. In this way the roads are built under some uniform system, with an eye to the future—especially in regard to drainage. With constructional operations in charge of such authority the work can be done more cheaply and more efficiently.

Good Drainage

The main consideration in building dirt roads is to have good drainage. The foundation should be drained by ditches large enough to give sufficient material to make a road-bed 18 feet wide, with an 8-ft. berm from the toe of any slope to the side ditches. It is a well-known fact that practically all parts of the country get dryer as years go by. This not only refers to surface water, but to changes in climatic conditions, from clearing same if it is a bush country, and from other natural causes if it is a prairie country. For these reasons these deep ditches can be partially filled up. This can be done with the excavation from the dirt roads when being prepared for an improved pavement, thus leaving a very solid foundation for the improved road.

This is a question to which enough attention has not been paid in the past. It will be found that 90 per cent. of all failure in new improved roads is from the settlement of newly filled depressions. It is too often assumed that filling these depressions in 6-in. courses and rolling will avoid any future settlement, but in practice this is not found to be the case. This is simply due to the fact that the different soils used in making these fills undergo some chemical action before becoming solid. If all slopes and berms, etc., are properly made in the first place, the cost of material will be less. The weed cutting will be a small item by the use of up-to-date weed cutting appliances enabling a team to handle at least five miles a day from ditch to ditch. I might end by saying that dirt roads especially need drainage, bottom and top.

The next class of road to be considered is a light gravel road, where the total depth of gravel is 9 in. after being consolidated. This should be made 9 ft. wide on what will be the right hand side coming to elevator or town of a future eighteen-foot roadway. Only a slight slope on road surface should be allowed viz.:—toward the right hand ditch. Temporary weeping drains every 100 ft. from the bottom of the gravel should be built. These are only considered necessary to keep the foundation dry, until the gravel consolidates enough from traffic to shed all surface water, and which under ordinary traffic will be in two or three years. It will save money to run the gravel through a crusher, and break all stones down to one inch. No screening is required.

As gravel will not bind itself, but simply binds from traffic and from pulverized soil, which is deposited on the road by wind or traffic, it is advisable in the first place to give the gravel a thin coating of loam, then sprinkle slightly and roll with a light roller, simply because the sooner you consolidate your road so as to carry ordinary traffic without rutting, the better it will retain its shape, and consequently the less it will cost to keep in repair. Under no circumstances have what are known as loose gravel shoulders; these are to be condemned in every class of pavement. They simply act as water catchers, which naturally soaks under the pavement, weakening the foundation. The only excuse of those who advocate them is that they help to keep the pavement cleaner. In my opinion it is cheaper to clean off a little dirt than to repair the damage to the foundations of any class of pavement.

Macadam Roads

Next consider what used to be called macadam roads. I use this term for the reason that, in my opinion, the day of macadam roads may be considered past, because the first cost of a properly built macadam road is about the same as a concrete road. The yearly cost of repairs is greater under any traffic, and under automobile traffic is prohibitive; also eventually it does not give as good a foundation as concrete, when an improved surface is placed thereon.

If a macadam road is already in existence and has been kept in proper repair, it can be surfaced with some asphaltic, tarvia or other surface mixture and made into a first class road for any traffic, but in doing so the bond of the old road must not be broken. Trimming and lining up must be done by the addition of new macadam well watered and rolled in before any surface mixture is applied. If the old bond has to be broken to suit any changes in grade, etc., it might as well be ploughed up and removed, as once the old bond is broken, uneven settlements will take place entirely ruining the grade of the new surface.

Concrete the Road of the Future

The fourth class of road is concrete. This I consider will be the suburban and country road of the future. Although concrete roads were tried many years ago and abandoned, it was not the fault of the concrete—it was simply the fault of the workmanship. There are some small stretches of concrete roads built 15 and 20 years ago and which have cost little to keep in repair and are in fair condition yet. There is nothing simpler to an experienced concrete man than making good concrete roads. Good drainage for the foundation, good earth foundation well consolidated. The use of proper material, proper proportions and seeing that the material specified in the specifications actually goes with the work.

For suburban roads 18 ft. wide; for country roads 9 ft., built as mentioned for dirt roads viz.:—on one side. At any future time this can be widened to 18 ft. The joint at the centre to be filled with tar and sand. This joint will not affect any future surface mixture. Expansion joints require to be made not less than 30 ft. apart and not more than 50 ft. Gravel run through a crusher the same as for gravel roads should be used, but it should be screened so as to obtain the proper proportions of the various sizes, in which case the concrete will be far superior to concrete made from broken lime stone and sand.

The interest on first cost, sinking fund and maintenance charges will be found to be less than on any other class of pavement.

To arrive at what will be the actual cost to any community for any class of pavement, these three items must be taken together, and also the question of the value of their investment after, say, 15 years, by which time the original cost should be wiped out. At the end of this 15 years concrete should be in good condition to be resurfaced with 2 in. of an asphaltic mixture costing 75c. per square yard, and which under ordinary care will last for another 15 years with approximately the same percentage as to cost for interest, sinking fund and maintenance. After that period the yearly maintenance cost will increase more rapidly. Up to a certain limit of expense it is cheaper to continue the repairs, but beyond this limit it is cheaper to remove the surface and put a new surface on at a cost of 90c. per square yard.

I may state that in some exceptional cases such as gravel or sandy soil, asphaltic macadam on a new macadam foundation may give fairly good results, but the surface mixture must be machine heated and mixed and not put on by what is known as the penetration system. There is too much risk of an uneven mixture with the penetration system. This system was only considered a make shift by experienced men trying to evolve some scheme that required very simple and cheap machinery and could therefore be adopted by small towns, etc.

Municipality Should Furnish Material

A few parting words of advice as regards building any class of pavement of which the main cost is made up of cost material. The central authority or municipality should furnish every class of material. It may be said it is not in their line, but the sooner they learn to do so, the better value will be get for the expenditure of the public money. They can finance as cheaply, and should buy as cheaply and will get exactly what they want, viz., the best in every case and they can do the work just as cheaply and in my opinion do it better if they simply adopt one rule:—put a practical man in charge and leave him alone. He will keep all patronage out to save his own reputation as being a practical man.

Irrigation Practice and Engineering—by B. A. Etcheverry, head of the Department of Irrigation in the University of California. McGraw-Hill Book Company, Inc., New York, publishers. Vol. II., specially devoted to a presentation of the fundamental principles and problems of irrigation engineering. While the author has endeavored to meet particularly the needs of teachers and students in technical schools, considerable descriptive information and cost data have been added, which makes the volume more valuable to engineers engaged in the construction and operation of irrigation systems. Well illustrated; 350 pages; size, 6 x 9½ inches approximately.

The city architect of Toronto, Mr. W. W. Pearse, has had tests made of all the brick supplied by the large brick manufacturing concerns in Toronto and the vicinity. The data and bricks are kept in a cupboard, and are available for the general public's use. The architect's department also has a cement-testing machine, and Mr. Pearse has recommended to the Board of Control the purchase of a wood-testing machine.

Edmonton Completes a Second Armoury

A substantial building costing three hundred thousand dollars—Completely and substantially equipped

A splendid new drill hall has just been completed by the P. Lyall & Sons Construction Company in the city of Edmonton, at a cost of approximately $300,000. The new armoury covers the entire block between 104th and 105th Streets, the main entrance on the south side facing on Churchill. The main drill hall is floored with asphalt, and is approximately 100 by 200 feet in area. Thirty-eight rooms, each 20 by 13 feet, open off the drill hall, to be used for offices and sleeping quarters for the men. On this main floor there is also a large battery gun room connected with the arena by big sliding oak doors. Solid oak has been liberally used throughout the building in the doors and staircases, which are permanent enough to withstand the hardest kind of wear. The floors of the living rooms are of selected birch on the main floor and of concrete and tile in the basement. Spiral stairways are placed in each of the four towers at the corners of the Armouries.

The second floor borders the main hall on the east and west ends of the south side. Across the east side are two large rooms set apart for sergeants' assembly rooms and for billiards. Adjoining is another large room which will probably be used for military bands. Opening off the gallery at this end there are also sergeants' sitting room, store rooms, and so on. The lecture and recreation room, and the officers' assembly rooms, take up the second floor space along the south side. These rooms are very large and well appointed, and arranged to open into one another by sliding doors. In the western end of the building are handsomely finished rooms for the officers, with billiard room.

In the basement are two sets of bowling and shooting galleries—one for the officers and one for the men. Similar alleys are installed along the north side for non-commissioned officers. On the basement level has been installed a very extensive sanitary system with separate units for officers and men. Lavatories are tile-floored and walled with enamelled pressed brick. The walls of the passageways, shooting galleries, and similar rooms are of red pressed brick with floors of concrete. The boiler and furnace rooms are slightly depressed below the level of the main basement floor. The heating and ventilation system is very complete.

The sub-contracts were all handled by Edmonton firms, as follows:—plumbing and heating, Freeze & Dobbin; painting, H. G. Franklin & Son; sheet metal work, Freeze Metal Company; electric light and fixtures, Burnham-Frith.

This is the second Dominion Government armoury to be built in Edmonton, the first, the Connaught Armoury, being erected on the south side of the river in 1911-12.

Edmonton's new armoury—Indicative of military spirit of Western Canada.

Large Credit Balance

Reports of trade-exports and imports published by the Department of Trade and Commerce, covering the year ending October, 1915, show the total exports increased by $96,296,139 and imports increased by $92,908,747. The total exports for the first nine months of the year amounted to $509,092,245, and the total imports for the same period $421,677,217, leaving a balance in Canada's favor of $87,415,028.

Tar paint better than lead paint on steel penstocks and draft tubes

WHERE water comes in contact with the paint applied to steel penstocks and draft tubes of the Minidoka power plant, tar paints have been found to be a satisfactory covering, according to an article by Barry Dibble in the Reclamation Record for September, from which the following extract, practically in full, and including the table giving costs of cleaning and repainting, has been made by The Engineering Record.

The shop paint was of red lead, or iron oxide, and oil. A further coat of red lead and oil was applied on the job, after assembling and riveting the pipes. After two years' service an examination showed that this paint had practically disappeared.

After considerable study and experiment, with unsatisfactory results, the following formula for red-lead paint, obtained from one of the largest paint manufacturers in the country, was adopted, the lampblack being used as a hardener for the surface:

First coat: 30 lbs. of red lead per gallon of linseed oil, using one-third boiled and two-thirds raw oil.

Second coat: same as above, with 4 oz. of lampblack a gallon.

Third coat: same as above, with 4 lbs. of lampblack to the gallon.

Paint was applied according to this formula during the winter of 1912-13. After part of this work was done the chief electrical engineer suggested that we try the material used on the Los Angeles aqueduct, and in accordance with his instructions we ordered water-gas tar for the first coat and coal-gas tar for the second and third coats. This was applied to penstock and draft tube 1.

Red Lead versus Tar Paint

At the end of the 1913 season the red-lead paints applied according to the above formula showed decided deterioration where in contact with water, while the tar was in very good shape except for slight rust spots around some of the rivets, where cleaning evidently had not been properly done. At the end of the 1914 season the lead paint had almost entirely disappeared where exposed to water and the tar paint was in good condition on the penstocks, but was apparently getting rather thin on the outside of the draft tube. Where the red lead does not come in contact with the water, as is the case on the upper part of the exterior of the draft tubes, it shows no deterioration and is now in excellent condition.

During the fall of 1914 the parts exposed to water on all the draft tubes were scraped, cleaned and repainted with water-gas and coal-gas tar. The accompanying table shows the cost of this work. There was a considerable variation in the condition on the different tubes, due to the fact that some had two coats of lead and some three, and also due to the fact that in some cases the weather was cold when the paint was applied, and it therefore may not have set sufficiently before being submerged in the water. The tar paint on draft tube 1 would, under ordinary circumstances, have gone a much longer time without renewing, but it was thought advisable to go over it in order to determine the condition of the tar coating and the iron underneath.

Cleaning Brush on Breast Drill

It will be noted from the accompanying schedule that a very large part of the cost of the work was involved in the cleaning. This cleaning was done by means of steel scrapers and brushes. With the lead paint the iron pitted badly, and it was necessary to clean out the loose scale thoroughly before attempting to repaint the metal.

The rivet heads, particularly, presented a serious difficulty with these scrapers, and we found it very slow to do a good job cleaning around them. After this work on the draft tubes was finished a special brush was made up which could be fitted over the rivet reads and revolved in a breast-drill frame. This worked very satisfactorily, and it materially reduced the cost of cleaning the penstocks.

In scraping draft tube 1 we found an excellent adherence between the metal and the tar paint, which had been on a year and a half at that time. Where it was scraped down to the metal it left a bright surface. On one patch, of about 1 sq. yd., apparently the iron had not been well cleaned before applying the paint, as it was in a place difficult to reach, and here scale had formed. This was the only place, however, where

Table I.

Cost of Cleaning and Painting Five Draft Tubes, Minidoka Power House

	Draft Tube					
	1	2	3	4	5	Total
Total surface, sq. yd.	170	170	170	170	170	850
Area cleaned and painted, sq. yd.	150	150	150	150	150	750
Cost of scaffolding:						
Labor	...	...	...	...	...	$52.32
Material	...	...	...	...	...	22.74
Cost of cleaning:*						
Sharpening scrapers	...	...	...	...	...	52.76
Labor	$37.42	$92.98	$58.00	$48.28	$85.10	321.78
Cost of painting, labor:						
First coat (water-gas tar)	7.40	11.99	2.60	6.70	12.93	41.62
Second coat (coal-gas tar)	10.95	16.69	10.16	10.10	12.06	59.96
Third coat (coal-gas tar)	None	None	None	8.50	None	8.50
Total labor, painting only	18.35	28.68	12.76	25.30	24.99	110.08
Material (all coats)	2.40	2.11	1.60	2.40	1.88	10.39
Total cost	...	...	...	...	...	$570.07
Cost per square yard cleaned and painted:						
Scaffolding, labor and material						$0.100
Cleaning, sharpening scrapers, and labor						0.499
Painting—						
Labor						0.147
Material						0.014
Total per square yard						$0.760

the iron had not been protected from the water. There was a marked difference in the ease with which this tar was cleaned off preparatory to repainting as compared with the work involved on surfaces which had been covered with red-lead paint, and had become pitted. It will be seen from the cost data that tube 1 was cleaned for about one-half the average for the other four tubes. Altogether the results with the tar have been most satisfactory.

There was quite a variation in the consistency of the water-gas tar purchased at different times. As ordinarily obtained it was necessary, in the cool weather during which we painted, to mix a little gasoline with it. Usually the mixture was about 1 qt. of gasoline to from 3 to 5 gal. of tar. This tar was then spread on carefully with a brush in the same manner as ordinary oil paint, it being carefully worked into all pits and around rivets. One gallon of tar covered about 30 sq. yds. with one coat. The cost was about 15 cents per gallon, about one-half of which was freight charge from Chicago to Minidoka.

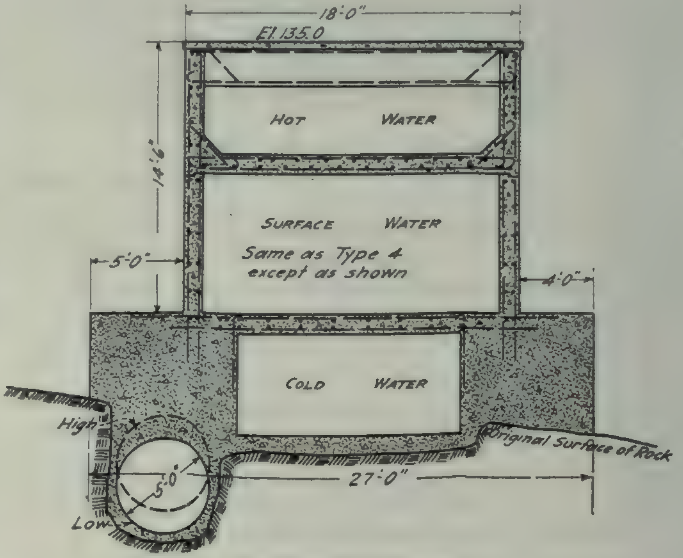
The tar is rather slow in setting, even if the weather is warm. It hardens when the thermometer drops. but when the weather warms up will become sticky even after a considerable period. As most of the work was done in cool weather, it was possible to apply the second coat within 10 to 14 days. In only one case (draft tube 4) were we able to get a third coat on prior to the time when the weather turned so bad that it was impossible to do outside work. It does not appear to affect the tar to put it into the water before it is thoroughly hardened.

Extensive Use of Concrete Planned for Fall River Improvements

It is seldom that the utility of concrete as the only material economically available is more clearly emphasized than in the underground construction work designed by Fay*, Spofford & Thorndike, consulting engineers, for carrying out much needed improvements at Fall River, Mass. For forty years the necessity for the improvement of the Quequechan River which flows through the centre of the city has been recognized.

Sewerage and surface drainage as well as the water supply to the numerous mills and the removal of heated water from the condensers have had to be considered, while at the same time conserving the present supply of water for power purposes and overcoming the noisome nuisance of large areas of exposed flats. This means that when the sewer is included at least three and in some places four conduits must be combined in a single piece of construction. The accompanying illustration shows a typical cross section. The lowest channel is designed to supply an adequate quantity of clean cold water to the mills. The top channel will carry hot water from the mill condensers to a cooling pond where the oil will be separated from the water and the water will be cooled and discharged into the supply pond. The middle channel will take the drainage of the adjacent territory, and will at times serve as an emergency channel for the overflow of the supply pond in times of flood.

In the construction of the main conduit, except in rock excavation, the base below the level of the bottom of the surface-water conduit is made broad and heavy to resist possible unbalanced lateral pressure on the side and possible upward pressure from water underneath. In this lower section, mass concrete is used with but a small amount of steel reinforcement, a type of construction which may be readily built within a cofferdam in the waters of the river, if desired. Furthermore, the broad base furnishes a suitable distribution of the weight of the conduit over the underlying earth. Above this base the vertical side walls and floors of the surface-water and hot-water conduits are of thin, reinforced concrete construction of economical type. In the larger sections of conduit, where the side walls are widely separated, a centre reinforced concrete wall is used as an intermediate support for the floors of the surface-water and hot-water channels; openings are to be provided at suitable intervals in these centre walls of both the surface-water and cold-water conduits to equalize the flow of water. The hot-water conduit is covered throughout with a reinforced concrete roof, in order to protect the public, to keep out intruders, to prevent the channel becoming a nuisance by the accumulation of refuse thrown into it, and to reduce the liability of freezing. Where the conduit is built in rock excavation, there is no tendency for it to overturn from unbalanced side pressure, or to float when its channels are empty, and a much smaller base section is sufficient. At these points, only enough rock is to be excavated to provide for the construction of a suitable concrete lining. This saving of concrete in the base section in rock excavation offsets to a large degree the extra cost of excavating rock instead of earth.



Cross Section of Conduit.

Wherever it is found that the conduit will rest upon good gravel, or other suitable bearing earth, no piles will be used for the support of the structure. In certain cases, however, soft material is found for a considerable depth below the bottom of the proposed conduit; here the structure will be supported upon piles driven to bedrock or to a hard stratum of earth.

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*Mr. Frederic H. Fay is a member of Canadian Society of Civil Engineers.

The usual provision for expansion of concrete structures will be made at suitable intervals in both the main and branch conduits. In addition to the vertical expansion joints, provision is also to be made for the expansion of the hot-water conduit independently of the remainder of the structure beneath it, as that conduit is subject to greater variations in temperature than the surface-water or cold-water conduits. Not only will the hot-water conduit be separated from the surface-water conduit by horizontal expansion joints, but the reinforced concrete beams supporting its roof are to be cast independently of the walls, and the roof slabs are to be independent of both.

The mills are connected to the main or branch conduits by intake and discharge pipes.

As a rule, each intake pipe consists of a reinforced concrete pipe running from the present intake pipe of the mill to a manhole at the side of the conduit. This manhole is so designed that the water can be taken from either the cold-water or surface-water conduits, or both, the gates being controlled from a small concrete house built on top of the manhole. The concrete pipe is laid at such a level that it can still supply water if conditions should arise in the future requiring the pond to be drained down to eight feet below full pond. The pipe is laid level from the conduit to a point as near as possible to the present intake; the latter may be lowered, in the future, at small expense, if desired. In general the pipes are in good foundation but at some points require a special gravel filling beneath them or even the use of piles.

Causes of Failure in Reinforced Concrete

Many of the losses suffered through the failure of concrete are due to carelessness and improper design. Common causes of failure are:

(1) Use of green and unseasoned cement as well as poor cement.

(2) Unsuitable aggregates, i.e., inferior grades of sand and stone. It is particularly necessary to avoid using any aggregate that may be handy. The best for the purpose should be chosen. It is also unwise to accept aggregates on the basis of small samples.

(3) An insufficiently graded aggregate, particularly one containing only very coarse material, or one with too much sand or loam. Natural aggregates are risky on account of the variations in the proportion of sand they contain, and should be screened before use.

(4) Dirty aggregate or water containing earthy matter, clay, loam, or strongly colored water.

(5) Carelessness in proportioning mixtures.

(6) Badly mixed concrete, i. e., incomplete incorporation of the aggregate with the cement.

(7) Too much water during mixing, or water carelessly applied, or an insufficient quantity of water to permit the concrete to attain its full strength.

(8) Allowing the concrete to stand until the setting action has commenced and then re-gauging before use, or using up old concrete.

(9) Setting concrete work on dry foundations and without thoroughly saturating the surface with water.

(10) Excessive ramming or tamping.

(11) Placing concrete in the winter months and allowing the material to become frozen before the cement has attained its final set.

(12) Excessive use of calcium chloride for lowering the freezing point.

(13) Placing concrete in very hot weather when the temperature of the water is around 90 to 100 degs. F., the cement at the same time being improperly seasoned, with the result that the cement gets an initial set in the mixer and is thereby broken when placed in the work.

(14) Excessive troweling or floating of cement surfaces.

This analysis will show that a great number of the failures are due to mechanical incompetency.

Concrete is one of the best and most reliable of building materials when mixed and put in place in a proper manner; where there have been failures in reinforced concrete buildings—or other reinforced structures, for that matter—it has generally been due to one or more of the following causes:

1. Premature removal of forms. Too early removal of forms has been the cause of most of the deplorable accidents in reinforced concrete construction.
2. Insufficient or badly arranged forms.
3. Erroneous design, i. e., errors in calculation or insufficient and poor reinforcement.
4. Mistakes in the construction of columns.
5. Unsuitable aggregate or cement.
6. Poor mixing.
7. Bad workmanship or inefficient supervision.
8. Misplacing or omitting the reinforcement.

—Construction.

Postage on Parcels Going to Soldiers

The Post Office Department, Ottawa, makes the following announcement regarding parcels for our soldiers in France.

The Department is in receipt of applications to have parcels, addressed to our soldiers in France, sent free or at reduced rates of postage, there evidently being an impression that this Department has control of these rates and could do as it wished. This is not so, as the question of postage is fixed by International agreement. Under International law, provision is made for the free transmission of parcels for prisoners of war, but this privilege does not extend to parcels for troops engaged in active service. The rate of postage required on parcels addressed to the troops depends upon the location of the addressee. If the addressee is in England, the rate is twelve cents per pound; if he is in France, the parcels are subject to the rates applicable to parcels for France, which are as follows:

1 lb.	$ .32
2 lbs.	.40
3 lbs.	.48
4 lbs.	.64
5 lbs.	.72
6 lbs.	.80
7 lbs.	.88
8 lbs.	1.02
9 lbs.	1.10
10 lbs.	1.18
11 lbs.	1.26

These are exactly the same charges which existed for years between Canada, England and France before the war, and are the result of an agreement made between these countries and Canada. In all cases parcels for the troops must be addressed care of Army Post Office, London, England, but this does not in any way affect the rate of postage which depends entirely upon the location of the addressee.

Macadam Roadways in Brussels, Ont.

Interesting details of two stretches of fine road built during the past summer — Will increase to 6000 feet during 1916

THE photos herewith show construction operations on a fine piece of new macadam roadway just completed in Brussels, Ont., by Thomas J. McLean & Company, Wingham. In January, 1915, the town council of Brussels decided to construct a macadam roadway through the central part of their town, and wisely set to work immediately and advertised for stone to be delivered on their property. This was obtained in sufficient quantities at thirty-five cents per ton, and before the good sleighing disappeared in the spring they had four thousand tons stored at well-chosen points in readiness for spring work.

Completed macadam roadway, Brussels.

Following the same aggressive policy, they called for early tenders for the construction of a 26-ft. macadam road with a cement curb 1,650 ft. in length. The contract was awarded to Thomas J. McLean & Company, of Wingham, as noted above, who completed this work early in the season and accepted a further contract for a 16-ft. macadam road 1,800 ft. in length, without curb, to which they have just now put the finishing touches. These two pieces of roadway are completed, one to the north, the other to the south of the town, both leading direct to the central point, and the Council contemplate joining these with the same kind of roadway early next spring. When this whole work is finished the town of Brussels will have a stretch of roadway 6,000 feet in length which will be a decided credit to the town as well as to the contractors, if the completed portion of the work is built according to the same standard as that just finished, which is counted one of the best pieces of roadway in the province.

The following cost figures with regard to these two pieces of roadway may be of interest to other municipalities contemplating similar work. The 1,800-ft. stretch, 16 ft. wide, without a curb, cost approximately $2,000, and the 1,650-ft. stretch, 26 ft. wide, with cement curb on each side, cost $3,500.

Not Covered by Act

An important decision affecting the city of Montreal, as well as other municipalities of the province of Quebec, was recently handed down by Mr. Justice Maclennan to the effect that the city is not liable under the Workmen's Compensation Act for injuries to their employees engaged in the repair or maintenance of the roads of the city.

Proposal to Erect Memorial Bridge Over Niagara Falls—Suggested Design

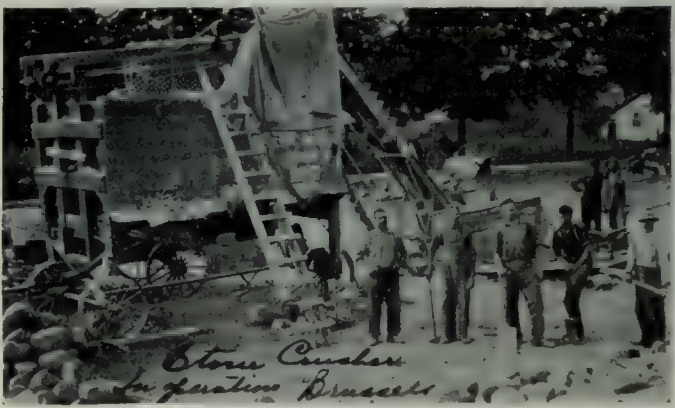
The illustration herewith represents the Memorial Bridge which it is proposed to erect across the Niagara River just below the falls to celebrate one hundred years of peace between English-speaking countries. The bridge was designed by Dr. T. Kennard Thomson, consulting engineer, 50 Church Street, New York, to whom we are indebted for the following interesting data.

"The bridge will be of concrete with heavy steel frame inside. The main span 840 feet, height above water 143 feet, width 100 feet, to typify the 100 years of peace in the past; the length, with approaches, to be measured by the thousands of feet to represent the peace of the future.

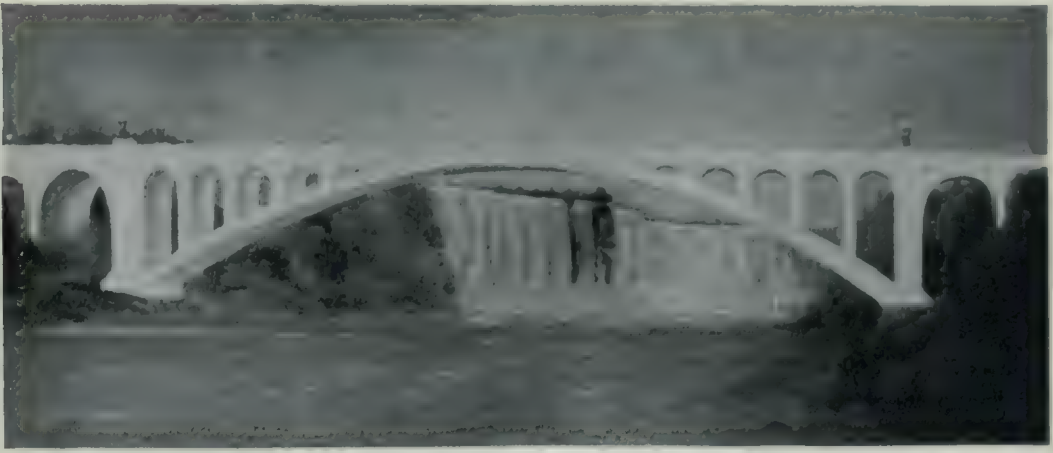
"Statues of the two greatest men of every country of the world should adorn this bridge that the benefits of the past peace may be brought to the attention of all.

"The first bridge to be built at this site was only seven-and-a-half feet wide, and was soon replaced by

Road roller in operation, Brussels.



Stone crusher in operation, Brussels.



Proposed Memorial Bridge over Niagara River, just below falls.

one of seventeen feet width; which blew down and was replaced by the third suspension bridge; which became so shaky that it was replaced by the present steel arch, which has caused alarm when heavily loaded and resulted in the gates being locked. So this will be the fifth bridge in the same location in about sixty years. No steel bridge over the Niagara River can be permanent.

"The design of the Memorial Bridge should have three essential requirements: 1st. Be of ample strength for any loading. 2nd. Be really beautiful. 3rd. Be built to last for ever."

Concrete in the Track Allowance

Many electric railway companies using it with success —A brief description of tried installation methods

By H. C. Campbell*

The widespread favor with which concrete is being received in the construction of street and highway pavements has aroused interest in its suitability for paving between car tracks. Permanence, ease of construction, moderate first cost and low maintenance charges are the distinctive merits claimed for concrete as a paving material. In Sioux City, Iowa, concrete paving between street car tracks has been used for a number of years and has given satisfactory and successful service. Some track in the city mentioned has ten-year-old concrete pavement which at the present time is in good condition. Concrete paving has been put in by the Sheboygan (Wis.) Railway & Electric Company, at Sheboygan and Plymouth, Wis., and the Mason City & Clear Lake Railway, Mason City, Iowa, has also had excellent success with concrete paving between its tracks in Mason City and Clear Lake. About three years ago six blocks were paved with concrete between the car tracks in Bay City, Mich., and the city engineer recently remarked that this was the best piece of pavement in the city. In addition to the cities already mentioned, Birmingham, Ala.; Denver, Col.: Port Huron, Mich.; Knoxville, Tenn.; Richmond, Ind.; Cleveland, Ohio; Minneapolis and Duluth, Minn.; Sioux Falls, S. D.; Manhattan, Kan., and Fond du Lac, Green Bay and Superior, Wis., have installed concrete paving in the track allowance.

Owing to the monolithic character of the concrete pavement, careful attention must be given to track design so that the necessity for frequently tearing up tracks will be eliminated. Efficiency of concrete paving between car tracks, therefore, depends greatly upon developing and using a type of track construction that will insure that the rails and other track fittings will endure as long as the pavement itself. Steel as well as wood ties, entirely embedded in concrete, have been used, and time has proved that both properly embedded in well-made concrete are protected from decay and corrosion, hence will certainly last as long as the pavement. Repairs to street railway tracks consist largely of rail joint maintenance. Unless a welded or riveted joint is used, no present-day type of rail connection escapes the necessity for occasional maintenance.

In most cities where concrete has been used for paving

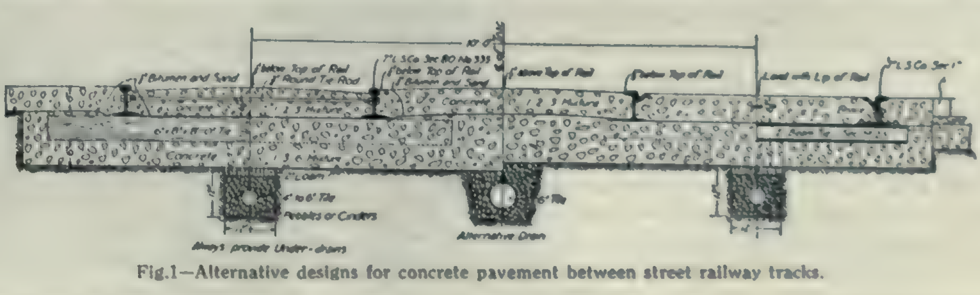


Fig.1—Alternative designs for concrete pavement between street railway tracks.

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*In Electric Railway Journal

between the tracks the material has been placed in practically the same manner as when paving the remainder of the street. Only granite and trap rock should receive consideration as coarse aggregate for concrete pavements in the track space. As vehicular traffic largely follows the tracks, especially in winter when the railways have swept away the snow, shock and abrasion are more extensive on this portion of the paved area than on the remainder of the street. If either granite or trap rock is used the pavement surface exposed to wear offers resistance to abrasion equal, in a properly proportioned and graded mixture, to that afforded by granite block pavement. When the film of mortar that is flushed to the surface by floating the concrete has worn off as a result of traffic abrasion, a properly constructed pavement will present the appearance of a mosaic in which the units consist of granite chips varying in size from ¼ in. to 1½ in.

As the street section occupied by car tracks often receives more than its share of heavy vehicle traffic, wear along the rails is excessive. Heretofore the practice has been to lay stone block beside the rail, but where the amount of traffic is not great concrete can be laid directly against the rail. Two methods of construction have been followed when concrete is used. In some cases a construction joint is placed parallel to the rail and directly over the ends of the ties, and in other cases the concrete is laid from the rail to the curb in an unbroken stretch. When a joint along the track strip is contemplated the form is set and the concrete deposited for the street pavement between this form and the curb. After this strip is hard the form is removed and the space between it and the outside of the rail is concreted, leaving nothing between the two stretches of concrete except the construction joint at the ends of the ties. Whether a joint running at right angles with the ends of the ties is used or not, is very much a matter of personal choice. If used, there is no necessity for cutting the street pavement proper when renewing rails or repairing tracks. If the street pavement proper is laid directly against the rails, the track must be very carefully constructed, otherwise if there is settlement or movement, the pavement usually cracks. Rail wear on curves is more rapid than on straight track, hence rail renewals are more frequent, and it is generally considered advisable to place a construction joint at the ends of ties on curves even though such practice is not followed on tangents.

When concrete is used for the entire pavement between rails, provision must be made for car-wheel flange clearance where the ordinary type of T-rail is used. In such cases the concrete flangeway is generally made 1 in. to 1¼ in. below the rail top. Investigation has disclosed that there is a strong tendency in present-day practice to form a deep groove for wheel-flange clearance. When the usual horse-drawn vehicle follows the line of rails, a detrimental prying action is exerted particularly when the wheels turn out of this groove, often resulting in chipping the pavement. To overcome this action a gradual crown can be obtained by using a strikeboard or template which is rested on the rails when striking off the concrete. Such a crown also provides drainage for the space between rails.

Generally speaking, the crown in the devil strip between tracks should start at the rail ¼ in. below the top and continue as a circular curve to the centre line of the strip. The ¼-in. clearance at the rail will allow for false flanges which otherwise cause the formation of a chamfer varying from ½ to 2 in. wide by ½ in. deep when the concrete is finished off flush with the rail top. As the car wheel tread is always equal to and usually greater than the width of rail head, any false flange wear will extend beyond the outside of the rail. Often wear in the wheels forms a slight flange on the tread, thus causing the outer portion of the tread to come in contact with the pavement surface unless the ¼-in. clearance is provided.

When concrete pavement is used in the track allowance rail braces instead of tie rods seem preferable, as the tie rods tend to decrease the net section of concrete. If tie rods are used, however, those having a circular cross-section are preferable to the rectangular type now common in track construction where block pavement is used.

Owing to the severe shock due to the diversion of traffic near switch and frog points, extreme care should be exercised in the concrete construction at these points. Perfect bond between rails and pavement can be secured if the pavement is properly and sufficiently protected while hardening. For this reason special care should be taken to practise the best curing methods and close the paved portion to traffic while the pavement is acquiring strength.

In the fall of 1914 there was constructed in the village of Lyons, Ill., about 8,500 sq. yd. of concrete pavement. About 4,450 ft. of this pavement included two car tracks with a devil strip and a 12-in. strip of concrete outside of the outer rails. The pavement was 11 in. thick between rails and 7 in. thick between tracks. Two-course construction was followed, the top or wearing course being 2 in. thick, calling for one part Portland cement and two parts aggregate, the latter consisting of two parts sand and three parts of granite chips ranging from ¼ in. to ½ in. in size. The base consisted of a 1:2½:5 mixture in which a clean, hard, crushed limestone ranging from ¼ in. to 1½ in. in size formed the coarse aggregate. A machine mixer delivering concrete by means of a spout (Fig. 2) was used on this work. Crown between rails and in the devil strip was obtained by the use of a template resting on the rails while striking off the concrete, and wooden hand floats were used for finishing.

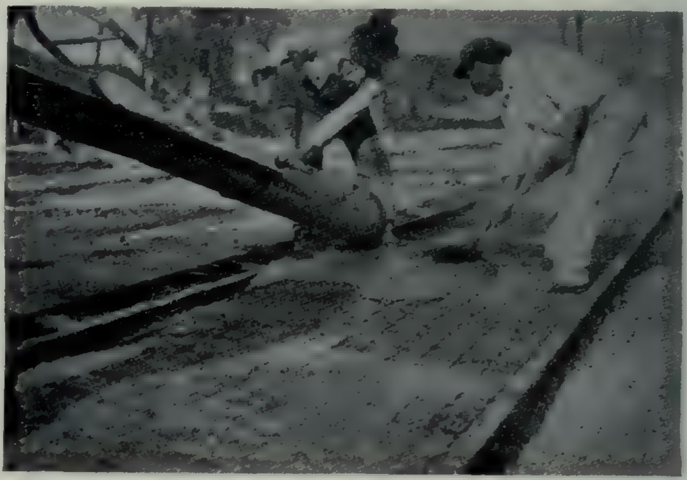


Fig. 2.—Spouting wearing course over mesh reinforcement laid on lower course.

Transverse joints 50 ft. apart were installed by using Baker plates and ⅜-in. Carey Elastite. An inspection of this work showed that many of these joints were low and uneven, which probably was a result of neglect properly to adjust the plates in the installing device and to finish even with the top of the plates. Finishing with a split hand float would have in part compensated for this. A longitudinal joint was placed at the tie ends and formed by two Baker plates, one was placed in the street pavement when it was laid and the other was placed with the 12-in. strip along the rails. Between these two plates a ⅜-in. Elastite expansion joint was installed. As the plate in the street pavement proper was sometimes placed too low and again too high, the contractor found it impossible to finish a neat joint. The

(Concluded on page 1236.)

Eugenia Falls Plant Placed in Operation

Hydro Commission of Ontario passes another Milestone—Twenty-five hundred horse power available in new plant—Another link in the chain of distribution networks

Another hydro-electric generating plant was successfully placed in operation on November 18th by the Hydro Electric Power Commission of Ontario. This was at Eugenia Falls, on the Beaver River, some thirty miles from Owen Sound, the largest town to be supplied by this system at the present time. The Eugenia plant is of particular interest on account of its 540-ft. head—the second highest, we believe, in the Dominion. Two units represent the initial installation, each of 2,250 h.p. on the turbine side and 1,200 kv.a. on the generator side. That the Commission have not misjudged the power requirements of this district is proven by the fact that the load with the first day of operation reached 856 kw., and that at the present time the amount of 1,500 kw. represents the daily maximum requirements.

Line drawings which indicate in a general way the conditions under which this plant has been installed are shown herewith. A somewhat detailed description of the equipment also follows.

With this plant in operation the Hydro Electric Power Commission of Ontario are in a position to cover practically the whole of the area of south-western Ontario, their Niagara plant and Wasdell's Falls, Ragged Rapids, and the Big Shute plants covering the southern and eastern portions. Ultimately all these different distribution systems will doubtless be tied in together, affording a unique network of distribution which will cover probably the largest area in the world under one control, and affording at the same time a high safety factor as regards continuity of service.

The Eugenia Falls system, as shown in Fig. 1, is supplied from a plant located at Eugenia Falls on the Beaver River six and one-half miles north-east of Flesherton. In Fig. 1 the dotted lines represent districts where construction work has not yet been completed. Power is generated at 4,000 volts, and stepped up at Eugenia to 22,000 for distribution to Owen Sound on the north, Shelburne to the south-east, and Durham and Mount Forest to the west and south. Distributing stations are located at Owen Sound, Chatsworth, Dundalk, Shelburne, Durham, Mount Forest. The line to Hanover and Chesley has not yet been constructed, but eventually distributing stations will be placed at these points. Transmission-line construction is according to the Commission's 22,000-volt standard, wooden poles being used throughout.

Markdale, on the Eugenia-Owen Sound line, is supplied direct from the generating station at the generated voltage of 4,000. The arrangement is 4,000-volt, Y-connected, for distribution at 2200 volts. The service wires for Markdale are carried on the same poles as the high-tension wires which supply Owen Sound, the lower voltage wires being placed a little lower down on the poles. Flesherton is supplied in the same way direct from the generating station; the distributing station from which lines go out to Shelburne and Mount Forest is actually placed at Flesherton Junction, and, as already noted, there is no distributing station at this point. The same arrangement is also used to supply Holstein, some five miles south from Durham, where again the 4,000-volt is installed along with the 22,000-volt wires until within a short distance of the village.

The drainage area of the Beaver River above Eugenia Falls is about 74 square miles. The Commission has installed a dam above the falls of about 1,800 acres area with a pondage of about 800,000,000 cubic feet. It is also possible to install another dam at Faversham which will give an additional pondage capacity of 300,000,000 cubic feet. However, this second dam will only be installed in the final development if found necessary for protection.

The maximum discharge at Eugenia Falls, as so far determined by gauge records and discharge measurements, is 99 second feet, which is equivalent to a run-off of 1.34 sec. ft. per square mile of watershed. The minimum flow, 31 sec.-ft., is equivalent to a run-off of .41 sec.-ft. per square mile and the average flow for 1913, 58.9 sec.-ft., corresponds to a mean annual run-off of .8 sec.-ft. per square mile.

The maximum static head at Eugenia Falls is 555 feet and the minimum static head 540 feet. The normal operating (effective head) is 540 feet and the minimum operating (effective head) is 515 feet.

As already noted, the Eugenia Falls plant is supplied from a storage secured through a main dam located above the falls providing storage of approximately 800,000,000 cubic feet. The water is carried from this point by a canal 5,000 feet long, 6 feet wide, to a pond of six acres capacity located in front of gate-house, where it is impounded by a second dam carried six feet above high water mark (earth filled type) 800 feet long; maximum height 30 feet; width at top 10 feet; wall slope, water side, 1 to 3; dry side 1 to 2 slope; rock toes; clay puddle core with puddle cut-off carried 5 feet below surface of ground; double lap timber sheathing carried 5 feet below bottom of cut-off trench to 5 feet above original surface of ground.

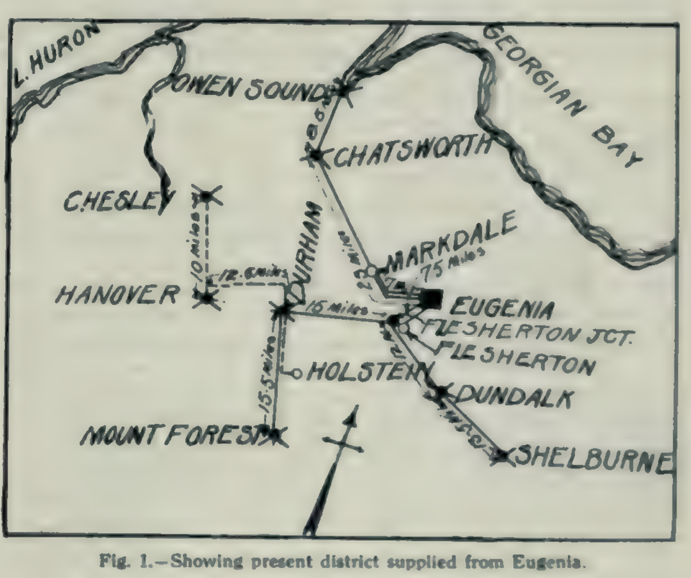


Fig. 1.—Showing present district supplied from Eugenia.

The gate house provides entry for two 46 in. wood stave pipes controlled by 66 in. butterfly valves electrically operated and controlled from the power house. Racks are housed and handled by chain block on trolley beam. The gate house is constructed of reinforced concrete with wing walls. The conduit line from gate house to head block is 3,350 feet in length. Head at gate-house is 25 feet; head at standpipe 105 feet. Head-block forms junction point for 46-inch wood stave pipes, 52-inch steel penstock and 46-inch steel riser to

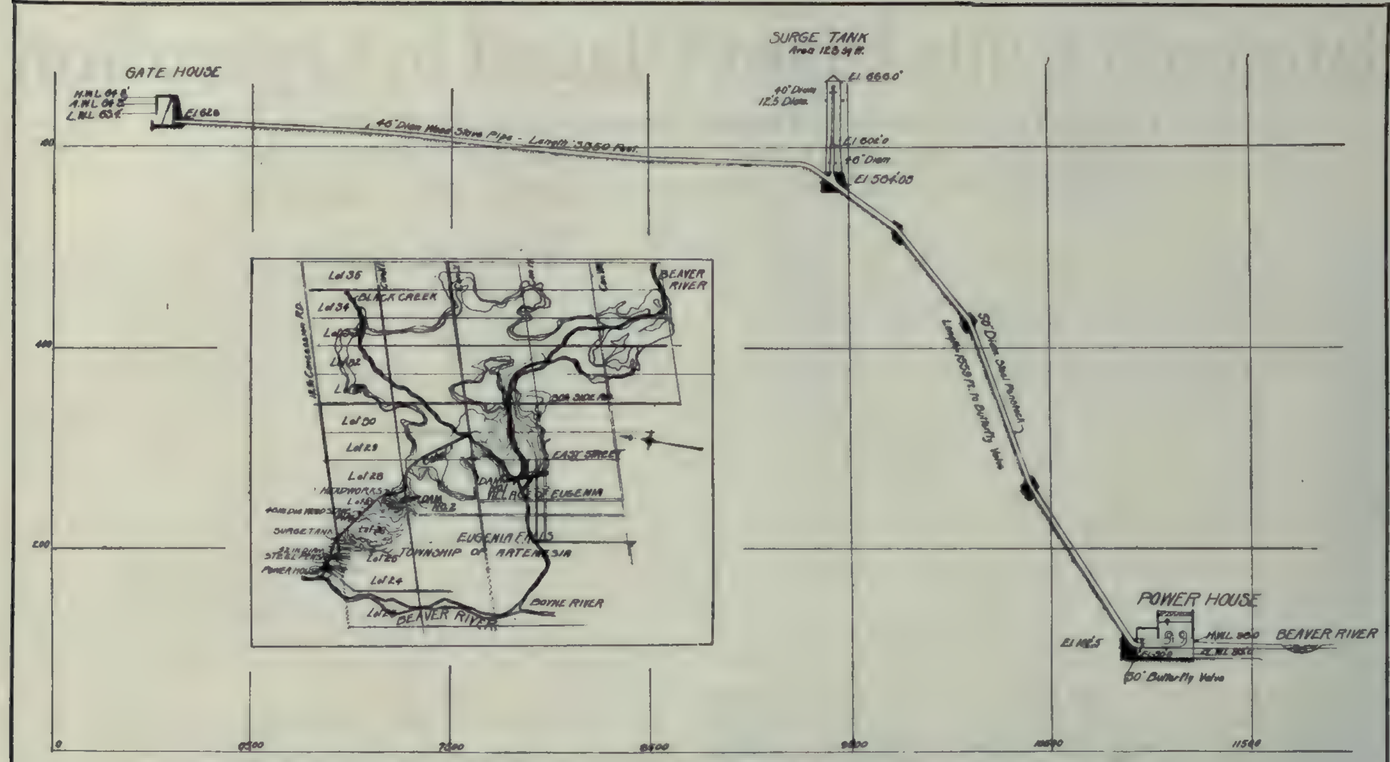


Fig. 2.—Profile and plan of the latest hydro-electric development of Ontario's Commission, Eugenia Falls.

surge tank and also furnishes foundation for surge tank placed on four steel columns 35 feet in height. Location of stand pipe shown in Fig. 2.

The surge tank consists of a 40-inch riser, 60 feet in length, inside a 12½ feet diameter tank 64 feet high, the base of which is connected to the penstock by a 38-foot pipe 46 inches in diameter.

The 52-inch penstock is constructed of steel, 5/16 inches in thickness at top and 27/32 inches in thickness at bottom. The penstock pipe line is 1,557 feet in length and supported every twenty feet on saddles; also anchored at each vertical bend with four concrete anchor blocks and provided with expansion joints below each point of anchorage. This penstock will be employed ordinarily to feed two machines, but cross connection is secured by means of a 35-inch by-pass, so that machines on number 2 pipe line (later to be installed) may be operated from number 1 pipe. The penstock supply is controlled by a 50-inch butterfly valve located just inside the power house and close to the water wheel. No. 1 penstock feeds two 2250-h.p. turbines of spiral single "Francis" reaction type. Each spiral casing is controlled by a 22-inch gate valve operated from the power house floor.

The turbines are of horizontal type with overhung runners and each is connected on the same shaft with a flywheel weighing 6,000 lbs., a 1,200 kv.a. generator and a direct driven exciter. The speed of the units is 900 r.p.m.

The power house proper is constructed with concrete foundation to floor level and brick and steel superstructure. The tail-race is 400 feet long and 10 feet wide at bottom. The walls of the tail-race have a 1½-1 slope; tail-race empties into Beaver River.

The electrical equipment in the power house consists of three 900 kv.a., 4,000/22,000 volt, 60 cycle, oil-immersed, water-cooled transformers; one 1,200 kv.a., three phase, 60 cycle, 4,000 volt generator 900 r.p.m., three 50 kv.a., 4,000/575 volt, three phase, 60 cycle oil transformers, as well as necessary switchboards, switching equipment, and lightning protection equipment. The sub-stations are built and equipped according to the regular Hydro Commission standards.

Turbines used in the Eugenia Falls plant are the well-known Escher-Wyss manufacture. The electrical equipment, including generators, transformers, switchboard, etc., were all supplied by the Canadian Westinghouse Company. The contract for the woodstave pipe was awarded to the Pacific Coast Pipe Company, of Vancouver; the surge tank was supplied by the Canadian Allis-Chalmers Company; the steel penstock by the Thor Iron Works, Toronto; the 66-in. butterfly valves at the head gates were constructed by the Boving Company, of Lindsay, and the 50-in. valve at the power house by the Canadian Allis-Chalmers Company.

Concrete in the Track Allowance

(Continued from page 1234)

only method of holding the inner plate up to the plate in the street pavement proper and against it was by braces set between rails and plate. This often required such a firm setting of braces that the track was thrown out of line. If any defects occur in this track construction later they are likely to consist of transverse cracks in the pavement between the rails at the rail joints and over tie rods owing to the nature of the track construction, which the paving contractor, of course, could not remedy. Rigid rail joints were not always secured in the track and cracks may later develop at these. Old rails and old ties were used and these will not give the desired results.

The Labor Department at Ottawa are having considerable trouble with some contractors on government work who are taking advantage of the war and have cut down the pay of their employees. In one case at least where government contracts were tendered for upon fair wage schedules approved by the Labor Department, the Department recently found that some contractors or sub-contractors paid their men less than these schedules demanded. The Hon. T. W. Crothers took vigorous action by notifying contractors that unless the men were paid in full the contracts would be cancelled. This has had the desired effect, and many thousands of dollars of back pay have been handed over to the workmen.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

When we think of the part the love of money is making some of our first families play in this time of trouble we cease to wonder why the dollar mark is fashioned after the image of the serpent that entered the Garden of Eden.

* * *

President Wilson has been too busy writing protests to Great Britain to teach his fiancee diplomacy else she would not try to buy her Paris gowns through a German firm. However, she has established her neutrality beyond the question of a doubt.

* * *

A correspondent writes to ask what Sir Geo. E. Foster and his department of Trade and Commerce have been doing to improve the opportunities offered for the expansion of Canadian commerce by the war and the banishment of Germany from the markets of the world—Canada at least. And the answer comes without a moment's hesitation. Sir George has been making speeches. You must have noticed that if you read the daily papers. Anyway, did you ever know him to be doing anything else? That is Sir George's forte. He talks and talks, and it doesn't matter a continental whether or not he knows what he's talking about.

* * *

When Sir Robert Borden came into power by virtue of a Liberal attempt to hitch this fair Dominion onto a foreign band-wagon, he found that the only cabinet legacy the old-time Conservatives had left him was the then Hon. Geo. E. Foster. He was the financial critic of the party, and in Opposition had been able to quote figures faster than the Liberal government could digest them. He was also the natural choice for Minister of Finance. But Premier Borden was well advised to the effect that a great critic is mighty little use for anything else. So he reached out, gathered in Tom White from the top of a trust company and almost from the ranks of the Liberal party, and made him Minister of Finance.

* * *

However, the Hon. Geo. Eulas was still on his hands. He could not think of anything he was really useful for—except making speeches—so he began to argue by opposites. "Friend Foster," he said to himself," "is a college professor. By training and education he is absolutely innocent of any knowledge of trade or business. Why not make him Minister of Trade and Commerce?" It was an inspiration. Hon. Geo. E. Foster became Minister of Trade and Commerce and he has held the job, or the job has held him, ever since. That he has been knighted by His Majesty the King is ample evidence that the country appreciates a man who can hold a job he does not know anything about and never did know anything about.

* * *

Now, as Minister of Trade and Commerce, what would you expect Sir George to do when millions of munitions contracts were floating around the continent to which he occasionally belongs? Wouldn't you think he would inventory his factories, obtain concise information regarding their fitness and capacity for producing war supplies, and, in short, do everything in his power to bring together the buyers of supplies and the men who could manufacture them? Well, you're right; that's exactly what he did not do. Instead, he went about addressing recruiting meetings. Lloyd George had said this is a war of munitions rather than men. So Sir George figured: "Munitions, why they might have to do with my department. So I'll go out after recruits." Of course, he's such a nice warm-hearted genial chap that men rushed to arms in millions as soon as he asked them to. But that's neither here nor there. The point is that Sir George "seen his duty and done it."

* * *

About the reaching out for markets left vacant by Germany's inability to navigate anything save the Kiel Canal! Oh, yes, Sir George went about that in the same wholehearted, soul-satisfying way. He kept right on making speeches.

* * *

But meanwhile his department is doing a great work in getting out blue books and a weekly trade report that is almost as useful to manufacturers as the financial pages of newspapers are to business men. By the time the information contained in them reaches the public, the opportunity is gone. In fact so valuable are these books that a live manufacturer rarely wastes his time reading them. However, they have their uses. The financial pages pounce on them and joyously announce to the country that the trade of the Dominion has reached a billion. And the manufacturer says, a trifle sadly: "That's nice, but how is it going to help me to get a South American market?"

* * *

Some day somebody is going to arise in parliament and ask: (1) How many trade opportunities have been developed for Canadian manufacturers by the Department of Trade and Commerce? (2) To what extent has trade in Canada been developed in the last ten years; how much of this development is normal and how much can be traced directly to the department?

And then Sir George E. Foster will make another speech.

* * *

Lloyd George has evidently sized up the politicians of Canada from his earlier experiences in munition contracts and instructed his representative to handle them gently and with kid gloves. For latest reports from Ottawa are to the effect that a letter from Sir Robert Borden to Mr. Hitchens is the royal road to a contract. The English munitions man is also said to act as if to ruffle the temper of the Minister of Militia would be equivalent to insulting the whole Canadian people. Such is the reputation our politicians and their profit-grabbing friends have given a Dominion whose sons are comparing favorably with the best troops in the British Army and who are going to the front as fast as the motherland calls for them.

* * *

Brigadier-General Bertram rises in his place and naively remarks: "It is a significant fact that I have been able to save so far $14,896,000 to the British tax-payer **by getting the work done that much cheaper than the War Office was prepared to pay.** And the brigadier would probably have been called to London to show the War Office how to save money if F. P. Jones hadn't happened along and showed how a further saving of $21,000,000 could be effected.

* * *

Corporations have no souls and consequently you could hardly expect them to have much patriotism. But the proposal that the Canadian government should impose a tax on war order contracts pre-supposes that the government is also without soul, conscience or patriotism. What would civilization think of a country that let war contracts for the motherland at extortionate rates of profit and then set about sharing in those profits? In other words, has Canada fallen so low that she would carry on her government with blood-money wrung from Britain? Let the tax on war contracts be imposed if a feasible method can be found, but let the money thus obtained be applied to buying those extra munitions it should have bought in the first place.

* * *

Wasn't it one righteous man that was required to save Sodom and Gomorrah? Doesn't it look to you as if one straight, honest, non-partisan man was required to save the government? Britain has Lloyd George, who has made munitions a business rather than a political perquisite. In the United States Pierpont Morgan has inventoried the factories and their capacities, and the man who can deliver the goods at the right price can get a contract. Is it not possible to place war contracts in Canada on the same basis? In this time of stress, when the Empire needs the united effort of all its people, I hate to be classed with the kickers. But wherever you turn it is the same cry of politics, pull and graft. There are the shell contracts, going to the favored few, the shell-box contracts, going to builders of dams, the contracts for uniforms going to the real estate men, the aged and decrepit horses bought in the east, the horses with abnormal appetites for hay in the west, strange tales of the Ross rifle and a faint echo from the submarines on the Pacific coast. The official investigator, Judge Davidson, a Borden government appointment, can't find time to make a report on one before he is hurried off to look into something else.

* * *

Britain will, as usual, muddle through the war, but whether the government of Sir Robert Borden will do likewise depends on whether it sees the error of its ways and finds a strong man to bring order out of chaos and reduce to business only this strange medley of business and politics. I am not prepared to see this fair Dominion handed over to the party who vainly tried to sell its heritage for a mess of Buffalo bologna. But the day of reckoning is coming, and Sir Robert Borden, if he would not share the fate of the doomed cities of ancient days, had better get busy and find his one righteous man—and having found him make him Minister of Munitions.

* * *

The death of Sir Charles Tupper brings forcibly before us the immense strides Canada has made within the years of one man's life. The "fighting doctor" had reached middle age when he helped with confederation; before the first transcontinental railway had begun to stretch its steel across the prairies or borrowed its first dollar from the government. The great west was a frozen fringe on the border of civilization fit only for trappers, Hudson Bay factors and other fur-bearing animals. Yet he lived to see those prairies producing hundreds of millions of bushels of the finest wheat in the world and great statesmen like Clifford Sifton and Bob Rogers; served by three transcontinental railways paid for by the government and owned by private corporations; sprouting real cities with real business and other cities with real estate booms; and grain growers' associations and elevator combines and all the other decorations that prosperity and politics could give to a young but husky country. He lived to see Sir Wilfrid Laurier make Canada a nation and then try to tie it up to an alien country with a reciprocity treaty. Yes, he lived through all this nor did he die before he saw the Canada that gave him birth standing shoulder to shoulder with the Empire he loved in the long threatened fight against the military despotism that threatened the freedom of the world.

"The Contract Record, of Toronto, starts out with: 'Here is an absolutely true story, etc.,' of something derogatory to Canadian officers in France. The Contract Record is the paper which published the lie about what F. P. Jones said to Premier Borden."—Ottawa Journal.

This a nasty criticism from a supposedly fair-minded journal. It is a good example, however, of the partisan press. The Ottawa Journal is probably too busy with Government printing contracts, and collecting rents for space rented to the Government in the Journal Building to know what is happening outside. The Contract Record told the truth about the shell game, and it said nothing derogatory of our "officers" in France. This is where the Ottawa Journal lies. The person the Contract Record referred to was not an officer. He was an "Honorary Colonel," which does not necessarily make him an officer. He had no military training whatever, and he was of no service to Canada or to the Empire. He was simply in the way of good officers trying to do their best.

* * *

On the same day and in the same paper come two announcements concerning the Imperial Oil Company. The first is that it has asked for a million dollars worth of the war loan, and the second is that it has obtained supplementary letters patent authorizing an increase in its stock from $15,000,000 to $50,000,000. Additional powers are also granted the company. Of course, there is no connection between the incidents. But it all goes to show what a rattling good investment the war loan is. For you could hardly accuse the Imperial Oil Company of buying from patriotic notions when it is alleged that its new office block on Church Street is being planned by a foreign architect and built by a foreign contractor.

* * *

I would like here to express my opinion of a certain Henry Ford, but I don't use that kind of language. This is the gentleman who told his U. S. friends he would like to see a tin can (doubtless his own make) tied to the tails of the British-French Commissions to the States. And, by the way, he is a bosom friend of Reverend MacDonald, Editor of the Toronto Globe.

* * *

Ford's latest fad is the chartering of a vessel to take delegates to a proposed Peace Conference to be held in Holland. In an interview in New York he is reported as saying "I want to put an end to this dreadful conflict, and I believe that we shall get the boys out of the trenches by Christmas Day." There is real humor in this. Can you imagine the representatives of Britain, France, Russia and Italy attending a conference designed by the designer of the Ford car?

* * *

When a treaty that will ensure the peace of Europe, perhaps for ever, is signed in Berlin, when the Kaiser is on his way to St. Helena, and when Germany agrees to indemnify the Allies to the last dollar—then, and not until then, will "the boys" leave the trenches.

* * *

An interesting lecture delivered before the Canadian Club of Toronto by Mr. C. W. Barron, President Wall Street Journal, adds further interest to some quite remarkable figures recently quoted in that journal regarding Canadian war orders and war order profits. The Wall Street Journal is a recognized authority on financial matters, and Canadians will read these figures with increasing hope that the Government will take some early action re taxation of these war profits, from which might be made up a nice little sum towards further purchases.

For example, it is stated in the Journal that the Canadian Car and Foundry Company's business (a Conservative Senator is president) consists of a number of shell orders, part of which has been sublet at a profit of $2.30 per shell. The Journal figures that on this basis total profits from munition orders will yield this company well over twenty million dollars this year, or enough to pay interest on their bonds and leave a balance of more than 150 per cent. on the combined issue of preferred and common stock.

Again, the Dominion Iron and Steel Company are said to be running at a rate of earnings equivalent to about eight million a year—sufficient to pay all accumulated dividends and still leave 13 per cent, on the common stock. The Steel Company of Canada is showing earnings at the rate of $500,000 monthly, and profits are running about 26 per cent. on the company's entire capitalization. The National Steel Car is understood to be earning at the rate of 40 per cent. on the common stock. The Nova Scotia Steel and Coal Company has just increased its capital by two and a half million "for the purpose of extending its scope for making further war orders." And, finally, Steel and Radiation, Sir Henry M. Pellatt, president, estimates a profit of $200,000 on a shell order which totals $380,000—an order which, according to the president, has since been duplicated—perhaps many times.

It is scarcely to be wondered at that one hears insistent reports that the British Government are placing themselves in a position, as rapidly as possible, to manufacture "at 'ome" all the munitions required.

* * *

Readers of these columns have no idea yet how disgraceful were some of the circumstances surrounding the awarding of these contracts; but more of this later.

* * *

We hope "Canadian," whose interesting letter is just to hand, will see his way to disclose his identity to us—for private use only, of course.

"SEARCHLIGHT"

Letters to the Editor

Wanted—a Man

The Editor, Vancouver, B.C., Nov. 22, 1915
Contract Record:

How often when reading of the infamy of the public business of our municipalities and provinces are we apt to exclaim, "What our councils and parliamentary houses require is a man," a man who can be trusted, a man whose integrity is above suspicion?

We are bold enough to exclaim that such a man would win the confidence and the admiration of his fellow countrymen, yet we look around in despair to find such a one. The investigation of one commission after another apparently proves our contention.

What! do we mean to admit that graft, deceit and dishonor are still running riot through our great and glorious country? If so, then, let us individually do our part to alter such a dastardly state of affairs. Too often we hear that "the whole administration business is rotten from the top downwards."

We can do our part, and the sooner we begin to act our part instead of grumbling and fault-finding, the better will it be for our Dominion. This is not a question concerning our fellowmen—it is a personal matter of vital importance—so let us examine carefully, and audit ourselves over this momentous question.

Are we still acquiring the exact and latest information concerning our own profession? Are we acting our part as manly men? or are we becoming incapable, lackadaisical and uninterested in our daily round and common task? If the latter we are not acting our part and as a sequence the whole staff is likely to become inoculated with the same bacilli of "don't care." Consequently, outsiders may imagine that if men in official positions would only do their utmost to be above suspicion, scepticism would quickly vanish.

The impression one should be most anxious to convey is that of being a true man in whatever official capacity you may be placed. Then, instead of the cry being "Wanted, a man," you will have acted your part well, and your actions will not only deserve success, but more than that—they will demand it.

Then will your fellowmen be enforced to state "we have found a man good and true and we will place that confidence in him he so richly deserves."

Yours truly,
MUNICIPAL ENGINEER.

Insurance of Office Tenure

The Editor, London, Nov. 10, 1915.
Contract Record:

Although your correspondence on this matter has apparently closed, I trust you will allow me to say a few words. My reason for not writing earlier was that I desired first-hand information, and that has taken me some little time to obtain. It may seem inconceivable that I, here, in the centre of things municipal, had no knowledge whatever of "Official Security, Limited." I had never heard any mention of an insurance of office tenure scheme, and I am afraid that even now, with full particulars of such a scheme at my elbow, I am not particularly impressed.

Much has been written, much spoken, about security of tenure, and so far—after many years—the result has been nil. The Institution of Municipal and County Engineers endeavored to form a voluntary fund for the purpose—they were prohibited by their Articles from forming a compulsory one—but without success. The Institution of Municipal Engineers formed a compulsory fund, which is still going strong, members subscribing without demur and the whole of the receipts being banked in a special account and earmarked for defence purposes solely. It may be asked: What was it that prevented the other body from forming a compulsory fund, and the question is simple to answer. The "Municipal and County" are registered and must do as the Board of Trade tells them. The "Municipal" are not registered and are free to do as they darn please. It will easily be understood that a government department would be loth to sanction anything in the way of a scheme so advanced as that of a defence fund!

I have now been carefully through the literature published by Official Security, Limited, and the first thing that strikes me is that no mention whatsoever is made of capital, beyond the statement that the company "has been formed specially by officials . . . . . . without share capital, so that all profits will be applied in the extension of the benefits or reduction of the premium, and a fund has been raised by the issue of debentures, but at least one-half of each risk and any sum over £500 for security of tenure is underwritten with two strong groups of Lloyds underwriters whose premium income is about £350,000 per annum." The question naturally arises: what is the amount of this fund? Lloyds may carry "a large part of every risk," but what of the remainder? Is this satisfactorily covered? It may be in the years to come, if claims are few and premiums many; but as things are I, for one, would not feel quite sure of receiving in the hour of trouble that for which I had been paying. It is quite possible that everything is as it should be, but it would be much more satisfactory if one could be assured on that point. Surely there is no reason why the amount realized from debentures should not be disclosed.

The use of this word "disclose" leads me to the question of the directorate, and here again one is quite in the dark. The governing trustee is "a clerk to commissioners of taxes"; the trustees (six in number) are "a town clerk, a medical officer of health, a surveyor and engineer, and three collectors of taxes." The arbitrator is the "president for the time being of the National Association of Local Government Officers," and here at last we have some indication of someone actually in the flesh, however often he may change his personality. The name of the secretary is necessarily given.

Now this is not at all satisfactory, and the fact that the town clerk mentioned is "clerk of a London borough of rateable value of £700,000 and vice-president of the London Borough Officers' Association," or that one of the tax-collectors collects £22,000 per annum, does not alter the case. Why not give names and addresses, or if officials fear victimization should they come forward, why not select superannuitants or "rank outsiders" of known probity and position? Personally, I should prefer the outsider, and that for the simple reason that there would then be no question of preferential treatment of the members of any certain body. I may be wrong, and I hope that time will prove me so, but I honestly don't place confidence in a concern run by men I have no means of knowing, with capital whose sum is an unknown quantity.

Mr. Blackman, in his first letter to you, speaks of a "record of sufficient names to present to an insurance company so that policies could be issued. The scheme has been worked out successfully in Great Britain, and . . . . . " The scheme has not yet been successfully worked out here; moreover, instead of an insurance company having names presented to it, the owners of such names have formed themselves into an insurance company, which is a very different thing. When a company of established credit, doing good business, and publishing the figures of its working capital and the names of its responsible directors or trustees, indicates its willingness to undertake the risks involved in security of tenure insurance, I am prepared to say that a successful scheme has been worked out. As matters stand, the risks are impossible of definition, and any such scheme must therefore fall within the category of hazardous. The only lines upon which a scheme can be run for some years to come—until, that is, data for working purposes have been obtained—are those which form the policy of Official Security, Limited, and when that company may see fit to throw aside its anonymity and show us how and by whom its concern is run I have little doubt that I shall be able to give it a measure of support.

I am,
Yours faithfully,
ENGINEER.

Major Cape given Hearty Send-Off

Major E. G. M. Cape, president of E. G. M. Cape, Limited, was given a very hearty send off by the members of the Montreal Builders' Exchange prior to his leaving for England in charge of the Third Overseas Battery Siege Artillery. He was entertained at dinner, at which his health was proposed by Mr. W. E. Sayer, who presented Major Cape with a revolver accompanied by a boquet of roses for Mrs. Cape. Major Cape replied urging the younger members of the Exchange to join the forces, leaving their positions to older and married men. It was pointed out that a majority of those present had either sons or relatives on active service, which showed, said the speaker, that the contractors of Montreal were doing their share not only in paying but in supplying men. Other speakers included Messrs. John Quinlan, the president of the Exchange, J. P. Anglin, William Ramsey, W. E. Potter, William Rutherford, Lieut.-Col. Costigan, Capt. A. Charlebois, and Lieut. Linton.

Pro Patria

Major Georges Janin, chief engineer of the city of Montreal, is reported among the missing from the "Anglia," which struck a mine while crossing the English Channel. Major Janin, who had raised a corps of engineers for the front, was being invalided from France to England, suffering from sciatica. He was on a long leave of absence from his duties in Montreal, the council paying him $3,000 a year, a third of his salary. Mr. Janin was a native of Poitiers, France, and in 1870 saw active service in the Franco-Prussian war. In 1892 he came to Canada, and after doing some general engineering work, entered the employ of the city in 1898 as acting superintendent of the aqueduct system; he was later appointed assistant superintendent, finally assuming entire direction of the water department. In 1910 Mr. Janin was promoted to be chief engineer, and in the intervening period has formulated the plans for the enlargement of the aqueduct and for the hydro-electric system for the generation of 10,000 horse power,—plans which of late have caused considerable controversy. Mr. Janin had three sons fighting in the French Army, and almost from the commencement of the war was anxious to be at the front, notwithstanding that he was not in the best of health.

The late Major Georges Janin

Personal

Mr. H. V. Armstrong, formerly city engineer of Estevan, Sask., has gone to Winnipeg.

Mr. William R. Curror has been appointed municipal engineer of West Vancouver, B. C.

Mr. A. M. West, late municipal engineer of North Vancouver, left for the front on November 16th with thirty-one other members of the Sixth Field Company, Canadian Engineers.

The present Mayor of Victoria, B. C., Mr. A. Stewart, who it is understood will again offer himself for election to the Mayoralty in January next, spent the early nineties as a contractor, and was associated with most of the important buildings erected in Victoria during the years from 1891 to 1895. One of the principal structures with which he was connected were the legislative buildings. In 1895 he began operating as a monumental mason as a side-line to contracting, but the success which attended him in this branch of work soon necessitated his giving it his whole attention, and when he retired from business in 1911 he had obtained an extensive connection. Mr. Stewart was born in Scotland, and came to the new world at the age of 17, devoting his energies to stone cutting, to which he had been apprenticed. From 1882 to 1888 he was engaged as a journeyman on many important works in the United States, his only connection with Canada at this period being as a member of the staff which constructed the cantilever bridge across the Niagara River, just below the Falls, in 1883. He went to Victoria in 1888, and has resided there almost continuously ever since.

Obituary

After an illness of over 12 months, Mr. J. Louis Michaud, chief engineer of the Department of Public Works, district of Montreal, died on November 14. Mr. Michaud, who was 64 years of age, was a native of Rimouski, P. Q. He was a Dominion and Provincial land surveyor, and was on the board of the provincial association. Mr. Michaud became an associate member of the Canadian Society of Civil Engineers in 1899.

Joseph Humphries, a well-known architect, carpenter and contractor, of St. Marys, Ont., is dead, at the age of 55. He was the architect for the public library, and for many other buildings in St. Marys and the vicinity.

Mainly Constructional

The Ideal Foundry and Hardware Company, Limited, Toronto, have obtained a charter.

The granite works of Milne, Coutts & Company, at St. George, N. B., have suffered damage from fire.

A Winnipeg concern recently incorporated is The North End Painters and Decorators, Limited.

The Italian Mosaic and Tile Company, Limited, Toronto, have obtained a charter.

Canada Builders, Limited, Toronto, have obtained a charter.

The Cheney Co-operative Water-Works Company, Limited, Cheney, Ont., have obtained a charter.

The work on the concrete footings of the Don Valley section of the Bloor Street Viaduct, Toronto, is practically completed.

The firm of Garden, Taylor, Roberts & Hawkins, surveyors and engineers, of Vancouver, B. C., has dissolved partnership.

The Westfield Manufacturing Company, Halifax, N. S., are making preparation for carrying out a big war order said to represent a value of between one and two million dollars.

The American Locomotive Company, Halifax, N. S., have closed a contract for two hundred thousand forgings for large shells. The value of the order is in the neighborhood of four million dollars.

The Wabi Iron Works have installed a new steel plant at New Liskeard, Ont. There are only four plants of a similar kind in Canada. The huge electric steel furnace will melt a ton of metal at one time, requiring five hours to do it.

Owing to reductions on account of the war, the work under the Colonization Roads Branch of the Ontario Public Works Department has been reduced by about one-half, in comparison with 1914.

The city of Prince Rupert, B. C., are endeavoring to secure shell contracts. Commissioner Wright has suggested that $30,000 be expended at the dry dock to equip it for the work. A local firm say that they could undertake the manufacture of one hundred shells a day.

A meeting of the Vancouver branch of the Canadian Society of Civil Engineers took place on November 18th at the Board of Trade Rooms, Vancouver, and Capt. Tweedale, of the Corps of Guides, gave a lecture on "Military Sketching and Reconnaissance."

Mr. B. L. McKenzie, a civil engineer, of Winnipeg, has been in Dryden, Ont., for the purpose of making a report and getting out specifications in connection with the proposed fire protection and domestic water supply scheme for the town.

It is announced that the first plant to be established in Newfoundland for the manufacture of shells for the British army will be put in operation early in January. A foundry in St. Johns has been secured, and is being transformed into a munitions factory.

Work on Winnipeg's new Law Courts building is at a standstill owing to the fact that the sub-contractors refuse to proceed with the work until they know the result of the investigations now being made. The building may not be completed until May.

The Hon. Robert Rogers, M.P., Minister of Public Works, was in Victoria recently for the purpose of seeing what progress had been made on the harbor works there since his visit of two years ago. Since then a large amount of work has been done on the breakwater and the piers, and this was inspected by the Minister.

The new Federal Building at Sudbury, Ont., a handsome building comprising the Post Office, Customs, and Inland Revenue Departments, was formally opened on November 13th by the Hon. Frank Cochrane, Minister of Railways and Canals, and M. P. for Nipissing, in the presence of a large number of citizens.

The new St. John's Presbyterian Church at Moncton, N. B., was opened on Sunday, November 21st. It is a handsome structure in brick and stone, and the design is based on a modern adaptation of Early English Gothic. The church has a seating capacity of eleven hundred, and there is also a large assembly hall capable of seating 850 people. The architect was Mr. H. G. Jones, of Montreal, and the contractor was Mr. E. B. Evans, of Montreal.

The Midland Engine Works Company, Midland, Ont., have a contract for the manufacture of 25,000 high-explosive shells. The shells are of a large size, being 6 inches in diameter and 18 inches long, machined inside and outside. The company are making preparations for the installation of new machinery, and expect to start work on the order in two or three months' time. It is their intention to employ local labor as far as possible.

Work on the construction of the Hudson Bay Railway is being rushed to make connection with Port Nelson in the fall. The steel track is laid for 242 miles from The Pas, over which a weekly train service is operated. The bridge at Manitou Rapids over the Nelson River is expected to be finished early in February. The material for the bridge at Kettle Rapids is being taken overland this winter. This place is ninety miles from Port Nelson, and the engineers are confident that they will make exceptionally rapid progress on the balance of the construction to the bay.

The Montreal Board of Control will appoint Mr. P. E. Mercier chief engineer, in succession to the late Mr. G. Janin, at a salary of $6,000 per annum. Mr. Mercier has been acting chief engineer since Mr. Janin went to the front. He was formerly a member of the firm of Baulne and Mercier, and has been an associate member of the Canadian Society of Civil Engineers since 1906. Mr. A. Martin, who has been acting as assistant engineer, will be officially given this position.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Bosanquet Township, Ont.
The Township Council are considering the construction of the Hampton Drain and other improvements. Clerk, G. Sutherland, Thedford, Ont.

Chatham, Ont.
The City Council have decided to lay a reinforced concrete pavement on Lansdowne Avenue next year. Work will be done by day labor under supervision of the City Engineer, F. P. Adams. Approximate cost, $3,170.

Edmonton, Alta.
A by-law to authorize the construction of a sewage disposal plant at an approximate cost of $275,000 will be submitted to the ratepayers on December 7th. City Clerk, C. E. Cox.

Goderich, Ont.
The Town Council have authorized the construction of a sewer on Lighthouse Street. Work may not be done this fall. Clerk, L. L. Knox.

Leamington. Ont.
The Town Council have authorized the construction of sewers on Russell and Mill Streets and on Victoria Avenue. Chairman of the Board of Works, Councillor Smith.

London, Ont.
The City Council contemplate extensions to the storm sewer system, to cost about $50,000, the installation of hydrants at the Fair Grounds, and the construction of sewers on Regent, William, Dundas and Elizabeth Streets. Clerk, S. Baker.

Penetanguishene, Ont.
The by-law to provide for the construction of extensions to the watermains was defeated.

Port Dover, Ont.
The Town Council are having plans prepared for the construction of a waterworks system. Engineers, James Louden & Hertzberg, 79 Adelaide Street E., Toronto.

Romney Township, Ont.
The Township Council are considering the construction if a number of drains. Plans will be prepared as soon as possible. Clerk, J. W. Kennedy, Wheatley, Ont.

Sherbrooke, Que.
The City Council are considering the construction of a subway on Richelieu Street. The work will probably include a portion of the proposed 4-foot trunk sewer. Estimated cost, $10,411. Clerk, E. C. Gatien.

Tweed, Ont.
The construction of a waterworks system at an approximate cost of $25,000 is being considered by the Town Council. Engineers, Kerry & Chace, Ltd., Confederation Life Building, Toronto.

Woodstock, Ont.
The City Council have decided to submit a by-law for the construction of extensions to the storm sewer system at the January elections. This work is estimated to cost $25,000. The construction of a glazed tile sewer on Duke St. has been authorized. Engineer, J. F. Ure.

CONTRACTS AWARDED

Enniskillen Township, Ont.
The contract for the construction of tile drains for the Township Council has been awarded to Camille Van Nielande, c/o the Clerk, G. V. Wyant, Petrolia.

Hamilton, Ont.
The City Council have let the contract for laying a rocmac roadway on Mountwood Avenue to Rocmac Roads Ltd., 74 King Street E., Toronto.

Leamington, Ont.
The general contract for laying a concrete pavement on Victoria Avenue has been let by the Town Council to Link & Scratch, Mill Street.

Toronto, Ont.
The Board of Control have awarded the contract for the supply of 500,000 granite setts to the Premier Granite & Sand Company, Montreal, at $48.25 per thousand.

Railroads, Bridges and Wharves

Magog, Que.
The Dominion Textile Company, Main Street, contemplate the construction of a concrete dam. Work will not start until next year.

Ontario Province
The Canadian Pacific Railway Company, Montreal, have been authorized to construct industrial sidings at mileage 61.2, Chalk River Sub-division, for M. J. O'Brien.

Portage la Prairie, Man.
The Board of Railway Commissioners have instructed the Canadian Northern Railway Company, Toronto, to construct a spur to serve the Canadian Oil Company, Ltd., in blocks 24 and 25.

Quebec Province
Permission has been granted to the Canadian Pacific Railway Company for the construction of a siding at mileage 71.2, Quebec Sub-division, for Alexander Cariere.

Toronto, Ont.
The Canadian Pacific Railway Company have been authorized to construct a siding for the Corporation of Toronto. The track will cross Mount Stephen Street on the east side of the Don River.

CONTRACTS AWARDED

St. John, N. B.
The contract for electrical work in connection with the bridge over the Reversing Falls has been let by the Provincial Department of Public Works to the Vaughan Electric Company, Germain Street.

Public Buildings, Churches and Schools

Allan, Sask.
The Trustees of School District No. 2914 have been empowered to borrow $5,000 for the erection and equipment of a school. Treasurer, A. A. Fraser, Allan.

Montreal, Que.
Work by day labor has been started on the erection of an addition to St. Aidan's Church, 284 Hamilton Street. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000. Pastor, Rev. E. A. Merryweather, 175 Dumas Street.

Mundare, Alta.
The Trustees of School District No. 1603 have been authorized to borrow $5,500 for the construction and equipment of a school. Treasurer, J. S. McCallum.

Thorold, Ont.
The erection of a school on the West Side is contemplated by the Public School Board. Chairman, J. H. Thompson.

Toronto, Ont.
Tenders will be received until 4 p.m., December 9th, by R. C. Desrochers, Department of Public Works, Ottawa, for the erection of a temporary postal station. Plans and specifications at office of T. A. Hastings Postal Station F., Toronto, and at the Department.

CONTRACTS AWARDED

Berlin, Ont.
In connection with the Library in course of erection on Queen Street, the contract for electrical work has been let to A. Lockbart & Company, the interior fittings to the Berlin Office & Fixture Company, Ltd., 34 Lancaster Street W., and the painting and decorating to Weber Bros., 36 Homewood Avenue.

Bothwell, Ont.
The contract for plastering at the new Town Hall has been awarded to A. C. Morgan, 27 Grant Street, Chatham.

Lachine, Que.
The contract for terra cotta wall lining at the school in course of erection on Fifteenth Avenue for the Roman Catholic School Commissioners has been let to LePailleur & Frere, 405 St. Joseph Street. Painting by day labor.

In connection with the fire and police station being built on Tenth Avenue for the City Council, the contract for architectural steel work has been let to the Montreal Architectural Iron Works Co., 157 Prince Street, and for painting to A. Jolicoeur, 235 17th Avenue.

New Glasgow, N. S.

In connection with the school which is being built for the congregation of St. John the Baptist, the heating and plumbing contract has been let to George Fraser, c/o J. Johnson, New Glasgow, and the plastering to J. D. McMillan, Albert Street.

Ottawa, Ont.

In connection with the alterations at the Collegiate Institute, the wiring has been let to Marchand & Donelly, Sparks Street, and the plumbing to J. T. Blyth, Frank Street.

Quebec, Que.

Work has been started on the erection of a chapel for the Patronage Laval, St. Sauveur Street. The general and masonry contracts have been awarded to J. Chevalier, 44 Renaud Avenue. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $45,000.

The following contracts have been let in connection with the school in course of erection on St. Charles Street for the Roman Catholic School Board:—carpentry, M. Cauchon, 307 Richardson Street; roofing, N. Durand, 445 Francois Street; heating, plumbing and electrical work, F. Gingras, 34 St. Augustin Street.

Toronto, Ont.

In connection with the Epworth Methodist Church in course of erection on Yarmouth Street, the masonry contract has been let to E. H. Thomas, 85 Hilton Avenue, and the carpentry to James McKenzie, 447 Gladstone Avenue. Approximate cost, $65,000.

Business Buildings and Industrial Plants

Anderdon, Ont.

E. Bondy, Anderdon Township, Amherstburg, Ont., is considering the erection of a barn at an approximate cost of $3,000.

Cottam Ont.

Earl Birch is about to erect a garage. Concrete block construction, felt and gravel roofing. Estimated cost, $3,000.

Dunwich Township, Ont.

James Law, Dunwich Township, Dutton, contemplates the erection of a barn and other buildings, to cost about $4,000. Fireproof construction.

Fort Erie, Ont.

The International Safe & Register Co. are considering the erection of an addition to their factory. Work will probably start shortly.

Hamilton, Ont.

The Proctor Gamble Company, Burlington Street E., have had plans prepared for additions to their premises, estimated to cost $7,000. Concrete foundation, brick construction, Barrett Specidation, brick construction, Barnett Specipart of work.

Plans are being prepared by A. W. Peene, Clyde Block, for rebuilding the coal shed of the A. W. Freeman Company, Ltd., 181 Hunter Street. Concrete construction.

Kingston, Ont.

J. M. Caines, 46 Montreal Street, are about to erect stables estimated to cost $3,000. Metal clad construction.

Lachine, Que.

The Dominion Bridge Company are building an addition to their girder shop at Lachine Locks. Steel construction, concrete foundation, corrugated iron roofing. Estimated cost, $22,000.

London, Ont.

Building Inspector A. M. Piper is preparing plans for a stores building for the City Council. Corrugated iron construction. Approximate cost, $3,500.

Napanee, Ont.

C. A. Wiseman will call for tenders about March 1st for the erection for a garage. Concrete and brick construction. Estimated cost, $4,000.

Nelson, N. B.

Donald Fraser, Ltd., Carlton Street, Fredericton, N. B., have commenced the re-erection of their sawmill on the Miramichi River. Material purchased.

Newcastle, N. B.

The Newcastle Curling Club are considering the construction of a new rink, and have appointed W. J. Jardine, W. A. Park and D. J. Buckley a Committee for the selection of a site etc.

New Glasgow, N. S.

The F. W. Woolworth Company, Ltd., have commenced the erection of a store at Provost and George Streets. Work by day labor. Architect, C. A. Mitchell.

Port Rowan, Ont.

C. D. Foster is considering the erection of a garage at an approximate cost of $3,500.

St. Marys, Ont.

St. Marys Portland Cement Company, Ltd., have commenced the construction of a rotary kiln. Only foundations will be completed at present.

Toronto, Ont.

Grimshaw Bros., 34 Brookmount Road, are receiving tenders on graining required at the stores and apartments which they are building on Queen Street East.

Work has been started on the erection of an addition to the premises of the Chapman Double Ball Bearing Company of Canada, Ltd., 347 Sorauren Avenue. Superintendent of Construction, J. F. Strickland, 23 Saunders Avenue. Brick construction, tar and gravel roofing, concrete floors. Estimated cost, $6,000.

Work has been started by John Bray, 803 Broadview Avenue, on the erection of a store and residence, estimated to cost $3,000. Brick construction, tar and gravel roofing.

Vancouver, B. C.

Plans are to be prepared for an addition to the premises of the American Can Company, 535 Railway Street. Tenders will be called when plans are completed and work will start in the spring. Local Manager, F. Bigger.

Wolfville, N. S.

R. E. Harris & Sons are considering the erection of a store, at an approximate cost of $3,000. Work will probably be in charge of C. H. Wright, Wolfville. Brick construction.

CONTRACTS AWARDED

Brantford, Ont.

The City Council have let the contract for the erection of a street railway station and and public convenience on Market Square to Schultz Bros. & Company, Ltd., 47 Albion Street. Approximate cost, $5,500.

Burnaby, B. C.

Work is about to start on the construction of an oil plant on Burrard Inlet for the Shell Oil Company, Fifth and Carolina Streets, Vancouver. The contract for docks, approaches and bulkheads has been awarded to the Vancouver Pile Driving & Contracting Company, Flack Block, Vancouver, and for oil tanks to the Canadian Willamette Company, Ltd., 902 Rogers Building, Vancouver. Superintendent, W. J. Prout, 1412 Burrard Street, Vancouver.

Copper Cliff, Ont.

The contract for painting at the club house which has been erected by the Dickie Construction Company, Ryrie Building, Toronto, for the Canadian Copper Company, has been let to A. E. Walker, c/o the general contractors.

Hamilton, Ont.

In connection with the addition to the factory of the Tallman Brass Company, Wilson Street, the carpentry contract has been let to A. Milne, 65 Mary Street, and roofing to Dennis & Jocelyn, 13 Walnut Street N.

Work is progressing on repairs to the premises of Mills Bros., Ltd., 29 King Street E. The general and plastering contracts have been awarded to J. F Mercer, 72 Barton Street E.

Huntingdon, Que.

The following contracts have been let in connection with the hall and office building which is being erected by O'Connor Bros., Chateauguay Street:—carpentry, P. McGinnis, Huntingdon; roofing, Phoenix Bridge & Iron Works, Ltd., 83 Colborne Street, Montreal; plastering, A. Thompson, Huntingdon; painting, G. D. Bicknell; heating, E. Henry; plumbing, A. N. McDonald; electrical work, E. Burrows. Tenders on interior fittings will be received until December 15th.

Ingersoll, Ont.

The general contract for the erection of an addition to the factory of Thomas Waterhouse & Company, Charles Street E., has been let to the Pedlar People, Ltd., Simcoe Street, Oshawa Steel frame and corrugated iron construction, concrete foundation.

Kingston, Ont.

Work is about to start on the erection of a warehouse and store for Miss Rose Devine, 447 Division Street. The general contract has been let to Harvey Campbell, Barriefield, Ont. Frame construction.

Merrickville, Ont.

In connection with the power development plant in course of erection for the Rideau Power Company, the contract for steel work has been let to the Dominion Bridge Company, Ltd., Carleton Chambers, Ottawa, the contract for waterwheels to W. Hamilton Company, 479 Reid Street, Peterborough, and the electrical work to the Swedish General Electric Company, c/o M. G. Henniger, 126 Brockville Street, Smith's Falls, Ont. Approximate cost, $80,000.

Montreal, Que.

In connection with the hotel in course

(Continued on page 47)

Tenders and For Sale Department

Greater Winnipeg Water District

TENDERS

for Bronze Castings and for Brass Pipe and Fittings for Venturi Meter

Sealed tenders addressed to the Commissioners of the Greater Winnipeg Water District will be received up to noon of **December 15th, 1915**, for the supply of miscellaneous Bronze Castings, Brass Piping, etc., which enter into the construction of a Venturi Meter.

Specifications and form of tender may be obtained at the office of the District on and after November 23rd, **1915.**

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners.

901 Boyd Building,
Winnipeg, Man.
November 23rd, 1915.
47-49

Tender for School Addition

Sealed bulk tenders addressed to the undersigned will be received up to one o'clock p.m. on **Monday, December 20th, 1915**, for the several trades required in the erection of addition,, and alteration to school building at Elmvale.

Plans and specifications can be seen at the office of The Contract Record, Toronto, at the office of the architect, John Wilson, Collingwood, or at the office of the undersigned at Elmvale.

All tenders must be accompanied by marked cheque made payable to the Secretary-Treasurer of School Section No. 5 Flos, for five per cent. of the amount of tender.

The lowest or any tender not necessarily accepted.

W. J. McGUIRE,
Secretary-Treasurer,
S. S. No. 5 Flos,
Elmvale, Ont.
47-50

Tenders for Public Lavatory

Bulk tenders only for all trades required in connection with the erection of a public lavatory on Keele Street will be received by registered post only, addressed to the undersigned, up to noon on **Tuesday, December 7, 1915.**

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering, as prescribed by the city by-laws, must be strictly complied with or tenders may not be entertained. Tenderers shall submit with their tender the names of two personal sureties or the bond of a guarantee company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman of Board of Control.
48

Debentures For Sale

Bids will be received by the undersigned until January 17, 1916, for $130,000 debentures, being $80,000 for construction of sewers and waterworks, and $50,000 for construction and equipment of an electric-light system in the town of The Pas, Manitoba.

Duration—20 years, payable at end of term.
Rate—5 per cent. per annum, payable yearly, on the second day of August. Coupons attached.
Date of debentures—August 2, 1915.
Assessment—$2,482,670.
Rate of taxation—general, 11 2/10 mills; school, 3 mills; debentures, 5 mills.

Debenture debt (this issue included)—$250,000.

The above issue is guaranteed as to principal and interest by the Provincial Government.

H. H. ELLIOTT,
Town Clerk.
47-52

Sealed tenders addressed to the undersigned, and endorsed "Tender for Temporary Postal Station "A," Toronto, Ont.," will be received at this office until 4.00 P.M., on **Thursday, December 9, 1915**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firms must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, November 26, 1915.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—88381.

A Real Opportunity to Purchase A Going Concern

Foundry and Machinery Establishment. Splendidly located and readily convertible for shell making. Address Box 263, Contract Record, Toronto. 46-48

Improvements in Use of Unloader Plows Developed at Panama

The unloader plows, used to clear continuous trains of flat-cars of dirt in disposing of material excavated in the dry at the Panama Canal, were covered top and bottom with sheet steel. To save digging the dirt off of aprons accidentally thrown back and covered in loading the cars, a short chain with a hook and a cable grip was used to attach the aprons to the moving unloader line and throw them in advance of the plow. A stretcher frame was erected over the track at the inner end of each dump to overhaul the unloader cable. The cable was attached to this frame by a chain having a soft link and a slip link. These features, which saved much time and trouble in using unloader plows in the Canal Zone, were brought out by Maj.-Gen. George W. Goethals in a paper presented recently to the International Engineering Congress.

When first used on the canal work, the unloader plow was a skeleton with a plate wing. It was weighted down with from 7 to 10 tons of ballast in order to keep it on the bottom of the cars and to prevent it from riding over the spoil. Pieces of rock were continually working under the bottom and over the top of the plow, and as there was no way for the debris to escape except by being ground out, constant damage was done to the car floors and trouble was also caused by the debris catching in the aprons. The plow was covered with sheet steel on the top and bottom and thus the small rock was excluded, while, by an adjustment of ballasts along the share of the plow, 3½ tons of weight were found sufficient to hold the plow on the floor, entirely overcoming its tendency to rise. At first it was necessary to spend several minutes in digging out the end of the cable attached to the plow from the spoil along the face. This waste of time was eliminated by forming gromets of old cable and attaching them to the plows, where they were always in plain sight, so that the unloading cable could be coupled to the Grommet without any additional labor. Time was also wasted at first in attaching the cable to and releasing it from the stretching frame, which consisted of two uprights held together and braced spanning the track. A slip link was placed in the chain which held the cable to the stretching frame, and a blow from an iron rod opened this link, allowing the cable to fall upon the car without the train stopping. In this chain there was placed a soft link with a breaking strain of 1½ tons, so that if anything checked the cable in the process of stretching this link would give way and save the cable-stretcher from being wrecked.

In handling material in slides or at other points where it was necessary to uncouple the cars from a train and back them alongside the shovels, the steel aprons that bridged the intervals between the cars were thrown back, in order that the couplings might be parted.

Business Buildings and Industrial Plants

(Continued from page 45)

of erection on St. Catherine Street E. for T. Bastien, 5 Beaver Hall Square, the contract for ornamental iron work has been let to John Watson & Son of Montreal, Ltd., 167 Wellington Street.

A. Lapierre, 175 Champigny Street, is building a store and two flats at Rielle and LeCaron Streets for A. Poirier, 126 Cote St. Paul Road. Brick veneer construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

Quebec, Que.

In connection with the warehouse which is being built for E. Falardeau, 143 Dorchester Street, the contract for plumbing and electrical work has been let to F. Gingras, 34 St. Augustin Street. Roofing and painting by owner.

The contract for painting in connection with the club house in course of erection for the Quebec Curling Club has been awarded to J. M. Tardivel, 4 Coté d'Abraham Street, and the heating, plumbing and electrical work to John Walker, 122 St. John Street. Masonry and carpentry will be done by the general contractors, L. H. Peters, Ltd., 10 Ste. Angele Street.

Sault Ste. Marie, Ont.

Work has been started on alterations to a store on Queen Street for the F. W. Woolworth Company, Ltd. The masonry contract has been let to McPhail & Wright Construction Company, Gouin Street. Tenders on all other trades are being received by the Architect, F. Thatcher, c/o owners.

St. Marys, Ont.

Odett & Simpson, St. Marys, are building an addition to the garage owned by James Cochrane, Queen Street. Cement construction.

Toronto, Ont.

The general contract for the erection of an office building at Church and Court Streets for the Imperial Oil Company, 311 Dominion Bank Building, has been awarded to Thompson Starrett & Company, 51 Wall Street, New York City. Approximate cost, $350,000.

Valleyfield, Que.

Work has been started on the erection of a forge and foundry building for the Castings Company of Canada, Ltd., 79 Yonge Street, Montreal. The general, masonry, carpentry, painting, heating, plumbing and electrical contracts have been awarded to the Lumber & Construction Company, Ltd., Mill Avenue, Lachine, the contract for steel work to the Structural Steel Company, 10 Cathcart Street, Montreal, and laying brick to F. Daoust, c/o owners.

Residences

Blyth, Ont.

Blanchard Herrington is considering the erection of a residence. Work will probably start in the spring.

Colchester South Township, Ont.

The erection of a residence is contemplated by Asa Fox, Potlake Road, Harrow, Ont. Estimated cost, $3,000.

Joliette, Que.

Work has been started by M. H. Basineb, Richard Street, on the erection of four flats on De Lanaudiere Street. Frame and brick construction. Approximate cost, $4,000.

W. A. Durand, Notre Dame Street, has commenced the erection of two residences on Manseau Street. Frame and brick construction.

Lachine, Que.

Work has been started by U. Proulx, 105 Second Avenue, on the erection of flats, estimated to cost $3,500. Brick construction, concrete foundation, felt and gravel roofing.

Levis, Que.

George Therrien, 34 Wolfe Street, has commenced the erection of a frame and brick residence on Fraser Street. Approximate cost, $4,000.

Work has been started by Xavier Couture, St. George Street, Villemay, on the erection of a residence on Parc Frechette Street, estimated to cost $3,000. Frame construction.

Morris Township, Ont.

Robert Forbes, Concession 3, Morris Township, Brussels, Ont., is considering the erection of a residence, estimated to cost $3,000.

Ottawa, Ont.

Charles Wyman, 249 Creighton Street, has commenced the erection of a residence, estimated to cost $4,000, and will do plumbing, heating and electrical work.

The erection of a residence on Glen Avenue is contemplated by A. E. Thoms, 155 Sunnyside Avenue. Double brick veneer construction, stone foundation, shingle roofing. Estimated cost, $6,000.

M. Davis, 139 Creighton Street, has commenced the erection of a residence on Union Street, estimated to cost $4,800. Contracts will be let shortly for painting, plastering, heating, plumbing and electrical work. Brick veneer construction, stone foundation, shingle roofing.

A. Davidson, 69 Grosvenor Street, is considering the erection of a residence on Fourth Avenue. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,000.

The erection of a residence is being considered by Patrick Hammill, 257 Bayswater Avenue. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,300.

Penetanguishene, Ont.

Mrs. Henry Zoschke intends to rebuild her residence as soon as possible. Stone, brick and frame construction.

Quebec, Que.

Gerard Rochette, 46 Bedard Street, has commenced the erection of a residence, estimated to cost $4,000. Brick and frame construction, stone foundation, felt and gravel roofing.

C. A. Vezina, 61 Des Prairies Street, has commenced the erection of a residence, estimated to cost $3,000. Frame and brick construction, stone foundation, felt and gravel roofing.

Work has been started by W. Bouchard, 18 Second Avenue, Limoilou, on the erection of two residences on Eighth Street, Limoilou. Frame and brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $9,000.

Jean Breton, 294 Hermine Street, has commenced the erection of a residence, estimated to cost $3,000. Frame and brick construction, pile foundation, metal and asbestos roofing.

Smith's Falls, Ont.

Work has been started by G. T. Martin, Daniel Street, on the erection of a residence on Annabella Street. Buff brick construction, concrete foundation, asbestos shingle roofing. Estimated cost, $3,000.

Thorold, Ont.

The Beaver Board Company have commenced the erection of a residence, estimated to cost $7,000. Frame construction, concrete foundation.

Toronto, Ont.

J. A. Tweed, 629 Ontario Street, is receiving tenders on the construction of concrete or brick walls under three residences at Rose and James Streets.

Work has been started by McMillan & Costain, 166 Main Street, on the erection of a pair of residences on Enderby Road. Brick construction, concrete foundation, shingle, tar and gravel roofing. Estimated cost, $3,800.

Work has been started by J. A. Kitchen, 209 Humberside Avenue, on the erection of a residence on Rushton Road. Brick construction, shingle roofing. Smaller trades will be let. Approximate cost, $5,000.

Work has been started by W. Morley, 114 Greenwood Avenue, on the erection of a pair of residences on Queen Street E. Brick construction, shingle roofing Smaller trades will be let.

J. Peacock, 187 King Street E., is building two pairs of residences on Bathgate Avenue, estimated to cost $7,200 Brick construction, shingle roofing.

Walkerville, Ont.

J. C. Pennington, La Belle Building, Windsor, is preparing plans for a residence to be built on the River Front for Tracey McGregor, 239 Brush Street, Detroit, Mich. Stucco and brick construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

Warwick Village, Ont.

James Brush, Watford, Ont., is about to prepare plans of a residence. Estimated cost, $3,000.

CONTRACTS AWARDED

Halifax, N.S.

In connection with the flats which have been erected on Robie Street for W. G. Kennedy, Marlborough Woods, the contract for heating has been let to Longard Bros., 213 Hollis Street.

Hamilton, Ont.

In connection with the residence which is being built on Fairholt Avenue S. by Sparks & McKay, 9 Fairholt Avenue S., the plumbing contract has been let to F. Wall, 1236 Barton Street E., and the electrical work to John Fish, 291 Crockett Street.

Kentville, N.S.

In connection with the sanatorium in course of erection for the Provincial Department of Mines and Works, Halifax, the contract for painting has been awarded to Fred Chuster, Wolfville, the electrical work to F. Mitchell, and the interior fittings to the general contractor, C. Wright, Wolfville.

London, Ont.

The general contract for the erection

of six residences for the Copp Syndicate has been let to T. Copp, care of A. M. Hunt, Dominion Savings Building. Approximate cost, $16,000. Work will start shortly.

Maisonneuve, Que.
The following contracts have been let in connection with the residence in course of erection for Mrs. N. G. Egrement, 529 Lafontaine Street:—masonry, carpentry and interior fittings, Guertin & Bouchard, 410 Parthenais Street; plastering, A. Deslonchamps, 199 William David Street; painting, J. E. Bourdon, 205 Jean d'Arc Avenue; roofing, heating and plumbing, W. Theriault, 283 William David Street.

Moncton, N.B.
J. A. Thibideau, Spurr Street, has commenced the erection of a tenement building, and has let the contract for heating and plumbing to E. Brooks. Frame construction.

Ottawa, Ont.
In connection with the residence which is being built on O'Connor Street by G. A. Clarke, 106 Kent Street, the contract for heating and plumbing has been let to E. Williams, 72 Glenora Street, and the electrical work to G. W. Matthews, 700 Albert Street.

The contract for heating and plumbing in connection with the residence in course of erection on Wilton Crescent for D. L. Campbell, 6 Driveway West, has been awarded to E. Williams, 172 Glenora Street, and the electrical work to the Dominion Electric Construction Company, 417 Sparks Street.

The following contracts have been let in connection with the residence in course of erection on Fairbairn Street for J. P. Rady, 156 Belmont Street:—plastering, C. H. Patterson, 873 Somerset Street; heating, Capital Hardware Company, 845 Bank Street; plumbing, Gervin & Lillico, 1095 Bank Street; electrical work, Dominion Electric Company, 344 Sparks Street.

The general contract for the erection of a residence for H. L. Morrison, 15 Ossington Avenue, has been awarded to Bower Bros., 133 Hopewell Avenue, and work has been started. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $4,500.

Outremont, Que.
In connection with the residence which is being built on Wilder Avenue by H. Candlish, 1080 Van Horne Avenue, the contract for brick work and masonry has been let to F. McMarquise, 2655 Esplanade Avenue, the plastering to W. Bibeau, and roofing, heating and plumbing to Jules & Mathieu, 1988 Clarke Street.

Quebec, Que.
The contract for roofing in connection with the residence in course of erection on Lamontagne Street for F. Nadeau, 40 Crown Street, has been let to E. Falardeau, 143 Dorchester Street. Plastering will be done by the general contractor, M. Cauchon, 307 Richardson Street.

Work has been started on the erection of a residence for G. Lelievre, 302 Valier Street. The contract for masonry has been let to V. Parent, 440 St. Francois Street, and the carpentry to J. Caron, 186 Napoleon Street.

In connection with the residence in course of erection on Conroy Street for J. A. Choquette, 106 Grande Allee Street, the contract for roofing, heating, plumbing, and electrical work has been awarded to N. Asselin, 36 Langelier Boulevard. Painting not let let.

Work has been started on the erection of a residence on Lamontague Avenue for F. Nadeau, 40 Crown Street. The general, masonry and carpentry contracts have been awarded to M. Cauchon, 307 Richardson Street. Approximate cost, $7,000.

In connection with the residence being built on Cartier Avenue by Pierre Savard, 246 St. Olivier Street, the contract for painting has been let to O. Barbeau, 14 Franklin Street, and the heating, plumbing and electrical work to E. T. Moreau, 176 Cote D'Abraham Street.

In connection with the residence being built on Aberdeen Street by A. Fackney, 107 St. Joachim Street, the carpentry contract has been let to Elie Cantin, 8 Conroy Street. Masonry and plastering by owner.

In connection with the residence which is being built on Maisonneuve Avenue for C. E. Bernier, 54 Claire Fontaine Street, the contract for masonry and plastering has been let to T. Giroux, Beauport, and for roofing, heating, plumbing and electrical work to J. Lafrance, 21 Plessis Street. Painting by the general contractor.

The contract for painting in connection with the residence in course of erection on Lafrance Street for O. A. Beriault, 108 Cartier Avenue, has been let to E. Gervais, 88 Bagot Street, and the roofing, heating, plumbing and electrical work to J. A. Fournier, 3 Cote d'Abraham Street. Carpentry and plastering by the general contractor.

Work has been started on the erection of a residence on Bougainville Avenue for J. B. Giguere, 166½ Lockwell Street. The general and carpentry contracts have been let to J. Nadeau, 139 Des Anges Street. Frame and brick construction, concrete foundation, metal and asbestos roofing. Approximate cost, $5,000.

D. Maranda & Frere, 812½ St. Valier Street, have commenced the erection of two residences for E. J. Payette, 831 St. Valier Street. Frame and brick construction, stone foundation, metal and asbestos roofing. Approximate cost, $5,000 each.

St. Marys, Ont.
The general contract for the erection of a residence for D. S. Whaley, Queen Street, has been awarded to Wood Bros. Red pressed brick construction.

Thorold, Ont.
Higgins, Herod & Wilson have commenced the erection of a residence on Pine Street S. for Richard Herod. Concrete block construction, stone foundation, shingle roofing. Estimated cost, $3,000.

Toronto, Ont.
The following contracts have been let in connection with the residence in course of erection on Indian Road for Miss Strachan:—carpentry, A. C. Smither, 121 Greenlaw Avenue; plastering, J. Boyce & Son, 166 Clinton Street; plumbing and heating, Fiddes & Hogarth, Ltd., 122 King Street E.; roofing, G. M. Bryan, 524 Yonge Street; wiring, R. A. L. Gray & Company, 85 York Street; painting, C. P. Button, care of the Architects, Eden Smith & Son, 199 Yonge Street.

The contract for plumbing and heating at the residence in course of erection on Goldwin Smith Drive for W. A. Skirrow, Florence Apartments, Bloor Street E., has been let to Shepherd & Abbott, 78 Harbord Street, and the painting to J. R. Robinson, 425 Sumach Street.

Power Plants, Electricity and Telephones

Cupar, Sask.
The Dalrymple Rural Telephone Company have been authorized to borrow $4.500 for the construction of their system. Treasurer, John Donald, Cupar.

Duval, Sask.
The Duval & Dukeld Rural Telephone Company have been empowered to borrow $2,800 for the construction of their system. Treasurer, W. E. Turner, Duval.

Glenada, Sask.
Permission has been granted to the Glenada Rural Telephone Company to borrow $2,500 for the construction of their system. Treasurer, Edgar Mott, Glenada.

Humberstone, Ont.
The by-law providing for the installation of a lighting system has been passed. Material will be furnished by the Ontario Power Company. Village Clerk, J. J. Wichman.

Huntsville, Ont.
The Town Council, in conjunction with the Hydro Commission, have decided to remodel the Town's electric plant and system and to build a new sub-station of brick and fireproof construction. Work will start shortly, and will be done under the supervision of the Commission. Town Clerk, T. M. Cullon.

London, Ont.
New plans will be prepared for proposed ornamental lighting system on Talbot and King Streets for the City Council. Clerk, S. Baker.

Loreburn, Sask.
The Bright Rural Telephone Company have been authorized to borrow $3,000 for the construction of their system. Treasurer, O. O. Kaldor, Loreburn.

Sherbrooke, Que.
The City Council are considering alterations and improvements to the water power, electric transmission and lighting plants. Clerk, E. C. Gatien.

Silton, Sask.
The Silton North-West Rural Telephone Company have been empowered to borrow $3,500 for the construction of their system. Treasurer. W. H. Carter, Silton.

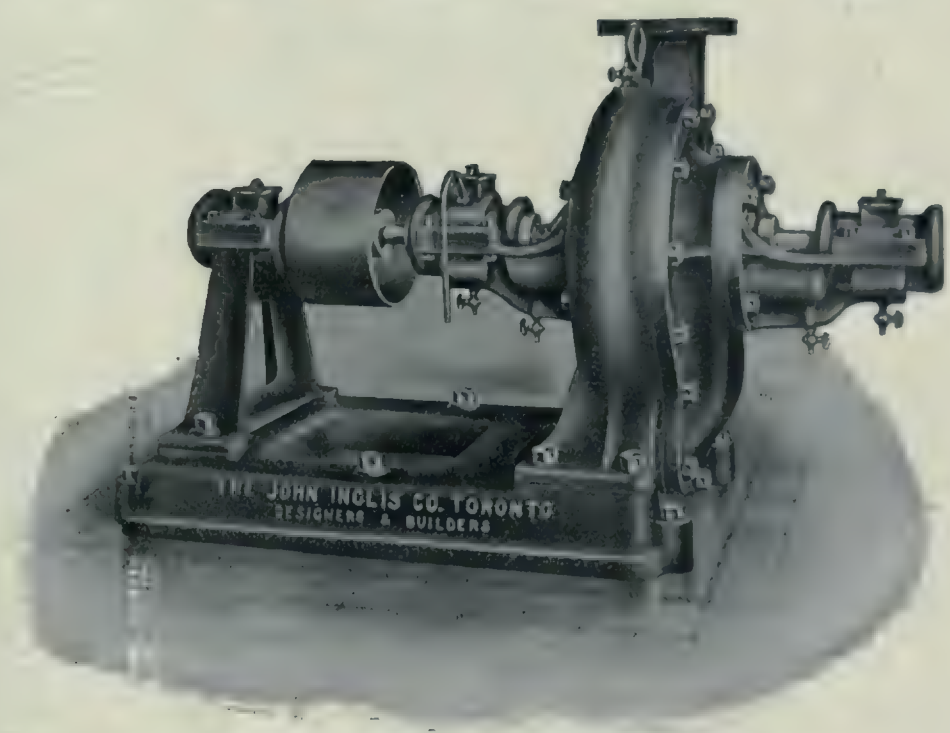
CONTRACTS AWARDED

Montreal, Que.
The City Council have let the contract for the supply of cable etc. to the Northern Electric Company, Ltd., 121 Shearer Street.

Toronto, Ont.
The Toronto Hydro Electric Commis-

(Continued on page 50)

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

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sioners, 226 Yonge Street, have awarded the contract for the supply and installation of about 8 miles of lead covered underground cable to E. F. Phillips Electric Works, Ltd., De Gaspe Avenue, Montreal.

Fires

Abbotsford, Que.
Fire has totally destroyed the store and residence owned by Alexis Bail. Some insurance is carried.

The store and residence owned by J. A. Messier have been entirely destroyed by fire. Loss is partly insured.

Balaclava, Ont.
Fire has destroyed the sawmill at Constant Creek, owned by Harry Richards.

Dutton, Ont.
Fire has totally destroyed a barn owned by James Law. Loss, $5,000, partially covered by insurance.

Hamilton, Ont.
The sheds on Terra Cotta Avenue owned by the Harris Abattoir Company, Ltd., have been entirely destroyed by fire, as well as the sheds of the A. W. Freeman Company, Ltd., 181 Hunter Street E. Estimated loss, $9,000. The Harris Abattoir Company intend to erect a brick building as soon as possible.

Isle Bizard, Que.
Fire has destroyed J. Lacombe's butter factory. Loss, $8,000, covered by insurance. Owner will rebuild and will require complete equipment.

Mountain View, Ont.
The barns owned by James R. Anderson have been completely destroyed by fire. Loss, about $5,000.

Miscellaneous

Comber, Ont.
George Wright is in the market for equipment and supplies required in the manufacture of brick and tile.

Crowland Township, Ont.
The construction of a garbage disposal plant is being considered by J. G. Stephenson, Welland, Ont. Brick construction, concrete foundation. Approximate cost, $20,000.

Deseronto, Ont.
G. A. Turner, care of the Canada Hardwood Manufacturing Company, Limited, is in the market for sawmill and woodworking machinery, automatic lathes, belting, etc.

Ottawa, Ont.
The City Engineer, F. C. Askwith, is receiving prices and other information with regard to vacuum cleaners.

The City Council are considering the purchase of a traveller, cable, boilers and steam drills. Engineer, F. C. Askwith.

Smith's Falls, Ont.
The Dominion Government Department of Railways and Canals are building a bulkhead near Ely's Lock, under the supervision of James Summers.

St. Marys, Ont.
C. Richardson & Company, Wellington Street, are in the market for machinery and material required in the manufacture of shells.

Sussex, N.B.
Thorn & Myers, plumbing and heating contractors, are receiving prices, catalogues and other information with reference to hot water boilers, steam boilers, black and galvanized pipe, soil pipe, plumbing fixtures and steam pumps.

Winnipeg, Man.
Tenders will be received until noon, December 15th, by S. H. Reynolds, 901 Boyd Building, on the supply of bronze castings, brass piping and other material required in the construction of a Venturi Meter. Specifications at office of the Greater Winnipeg Water District.

Late News Items

Bury, Que.
The Hotel Imperial, owned by P. Gillis, has been destroyed by fire. Loss, about $16,000. Owner intends to rebuild.

Edmonton, Alta.
A By-law has been passed authorizing the City Council to enter into a contract with G. W. Farrell & Company, 43 St. Francois Zavier Street, for the supply of power. A power plant and electric railway will be constructed at an approximate total cost of $6,000,000. Clerk, C. Cox.

Hamilton, Ont.
The contract for painting at the Mount Hamilton Hospital has been let by the City Council to Marshall & Brider, 12 Smith Avenue.

Lachine, Que.
The Dominion Bridge Company, Ltd., Lachine Locks, are building a brass foundry estimated to cost $20,000. Steel construction, concrete foundation, corrugated iron roofing.

Owen Sound, Ont.
The Grand Trunk Railway are about to start work on the rebuilding of their wharf. Material is on the site. Approximate cost, $10,000.

Regina, Sask.
In connection with the office and warehouse building in course of erection for the Robert Simpson Company, Queen and Yonge Streets, Toronto, the contract for belt conveyors, etc., has been let to the Lamson Store Service Company, Boston, Mass., and for interior fittings, shelves, partitions, etc., to Cushing Bros., Dewdney and McIntyre Sts., and to the Western Manufacturing Company, Dewdney and Halifax Streets.

Sydney, N.S.
The contract for electrical work at the hospital in course of erection for the City Council has been let to E. D. Murphy, 2 Pitt Street, and the plastering to the general contractors, Chappell Bros., 62 Brooklands Street.

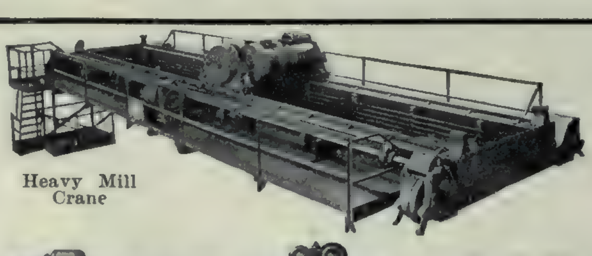
Toronto, Ont.
Work has been started on interior alterations to the store and office building at 96-98 Yonge Street for Ellis Bros., 108 Yonge Street. The masonry contract has been let to Thomson Bros., 151 Rusholme Road. Approximate cost, $14,000.

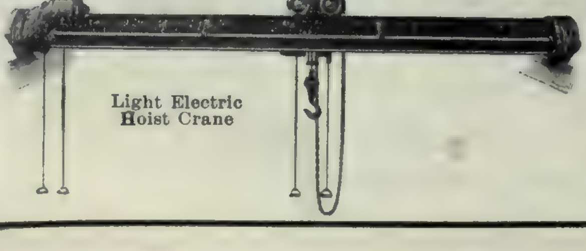
The contract for masonry required in the erection of an addition to the premises of the Smith Manufacturing Company, 201 Front Street E., has been let to Hall & Son, 6 Park Place, and the contract for steel sash to H. Hope & Sons, Limited, 45 King Street W. Estimated cost, $6,000.

James McKenzie, 1425 Queen Street W., has commenced the erection of two residences at 171 Indian Road. Smaller trades will be let. Brick construction, shingle, felt and gravel roofing. Approximate cost, $8,000.

The Board of Control will receive tenders until December 7th for the erection of a lavatory on Keele Street. Plans at office of the City Architect, City Hall. Brick and tile construction.

Windsor, Ont.
Work is about to start on remodelling business premises for the Windsor Ice & Coal Company, McDougall Street. The general contract has been let to Lambert & Braithwaite, 10 Riviera St., Sandwich. Estimated cost, $12,000.


Heavy Mill Crane


Light Electric Hoist Crane

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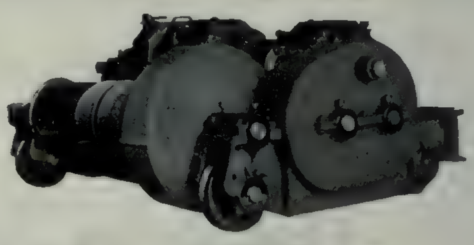
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ESTABLISHED 1886

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Civic Improvement League

A preliminary conference was convened at Ottawa on Friday, November 19th, by the Commission of Conservation, which was attended by about one hundred delegates representing various branches of civic workers. The object of the meeting was to discuss the question of organizing the formation of a Civic Improvement League for Canada, for the purpose of promoting the highest interests of the Dominion and the welfare of its citizens by the study and advancement of the best principles and methods of civic improvement and development and by securing a general and effective public interest in all municipal affairs. It was unanimously decided to form such a league, and steps were taken to carry out the scheme by means of a national council representative of the nine provinces of Canada, and through such council to establish branches of the league in each city, town, and municipality in the Dominion, or arrange for the affiliation of existing local societies with the league.

* * *

The undertaking sounds somewhat ambitious, but, no doubt, under the aegis of the Commission of Conservation, with the guiding hand of Mr. Thomas Adams, the Town Planning Adviser, the new league will prosper. We hope it will. There is ample room for such a league, for hitherto each provincial and municipal authority has been acting more or less on its own initiative, without much regard to uniformity of method or unity of purpose. It is not anticipated that any drastic or sudden change will result from the activities of the league, and it is well that this should be borne in mind; but in the course of time, by the education of the people, and by the creation of a powerful public opinion, changes will gradually take place—perhaps imperceptibly, yet assuredly—which will be founded on a permanent basis and, we believe, productive of excellent results.

Canada's National Resources

Dominion War Bonds Issued	**$ 50,000,000**
Dominion War Bonds Subscribed ..	**$110,000,000**

This looks like, if money is going to win the war, the British Empire is going to be "in" at the finish. The subscriptions would doubtless have been much heavier had the result not been a foregone conclusion.

* * *

Municipal government, with its multitude of problems, must be established on firm foundations if we are to expect enduring developments, and as long as many forms of city government are being tried out in other countries we shall do well to study them and watch for the valuable points and weaknesses. Then in the event of any such systems being adopted in Canada the electorate will be fortified by foreknowledge as to what are the fortes and failings of each municipal system, and also what is expected of the rate-payers themselves to make any system a success. If the Civic Improvement League can arouse the people to take an interest in municipal affairs, it will not be long before town planning in the broadest sense will become rooted in their minds, and more efficient, economical and reasonable administration will be the outcome.

A Bureau of Scientific and Industrial Research

An important move has just been made by the Royal Canadian Institute in the formation of a Bureau of Scientific and Industrial Research and School of Specific Industries. The functions of the Bureau are outlined briefly as the promotion of a closer alliance between science and industry in Canada, and the furtherance of scientific and industrial research. It is proposed to undertake perplexing manufacturing problems and work out practical commercial solutions of the difficulties met by industrial organizations, and to assist in every possible way in placing the industrial and commercial life of Canada in a position to compete with the most advanced countries in the world.

* * *

In his inaugural address President Frank Arnoldi, of the Royal Canadian Institute, indicated in a general way the causes leading up to the formation of this Bureau at the present time. He pointed out that conditions after the war will be very different from what they were before the war. Industrial competition will be keener than ever, and one of the most apparent necessities of the present time is an awakening of the interest of industrial authorities and governments throughout the British Empire, and more particularly in Canada, in the application of more scientific methods to our manufacturing problems. Mr. Arnoldi emphasized the truth of the fact (which none of us at the present time are too ready to admit) that Germany's industrial prominence is largely the result of a better appreciation of the value of the application of science to industry. If Canada hopes to be in the running when the keener competition, which must inevitably follow the war, sets in, it is high time that our industries should be organized and our methods of manufacture placed on a more scientific and economic basis.

Canada Richest Country in World Per Capita

Speaking of Canada's war debt and our ability to carry it, almost without effort, a writer in the New York "Annalist" says:

"In developed natural wealth Canada is the richest country on the globe in proportion to her population to-day, or even ten times that, and this war debt is for such a wealth-producing posterity to carry. That the interest charges on the debt are well within the power of the present population is indicated by the fact that the increase in revenue, plus the reduction in ordinary expenses of government, and in expenditures on capital account, as compared with the corresponding period a year ago, aggregated nineteen million dollars (for a seven months' period), which is four million dollars more than the annual interest charge at five per cent. on the entire estimated war expenses for 1915."

* * *

The need for a closer application of scientific methods in manufacture has of course been recognized by our larger industrial companies for many years, as is evidenced by the expensive and thoroughly equipped laboratories maintained by many of these companies. Indeed, up to the present time it has been possible for only the wealthier companies to maintain such a necessity as a research laboratory, on account of the tremendous cost involved. And here of course is the biggest problem confronting the recently formed Bureau; they need, if they are going to do successful work, a very large sum of money. To the industrial student who has foreseen the necessity for such an organization as this now formed, but has also foreseen the difficulties in the way of its success, the only reasonable solution appears to be that our governments, preferably the Dominion Government, should control and finance such an organization. We understand, too, that this is the hope of the Board of Governors of the Royal Canadian Institute. They felt, however, that a start had to be made, and the formation of this Bureau as a branch of the Royal Canadian Institute appears, in the wisdom of that Board, to have been the proper means of bringing this important matter before the attention of the citizens of Canada and of our Governors.

* * *

As indicative of the type of information the Bureau will endeavour to secure, it has just been announced that a lecture will be delivered in the Physics Building of the University of Toronto on Thursday evening, December 9th, by Dr. Saul Dushman. This lecture will be under the combined auspices of the Bureau of Scientific and Industrial Research and School of Specific Industries and of the Canadian Manufacturers' Association. Dr. Dushman is a graduate in the Faculty of Applied Science and Engineering of the University of Toronto, and was for some time a member of the staff. Since leaving Toronto he has been engaged in scientific research work in the laboratories of the General Electric Company at Schenectady, and the results of his investigations have been recognized for their importance all over the world.

American Road Builders' Convention

The date for holding the next Annual Convention of the American Road Builders' Association in Pittsburg has been changed from the week of February 22 to the week of February 28, 1916, the closing day being March 3. This meeting, which will be the only one of the American Road Builders' Association in 1916, will be the thirteenth annual convention of the association. It will also be the sixth American good roads congress to be held under its auspices, and will include also the seventh National Good Roads Show of Machinery and Materials. This show or exhibition will be held in Mechanical Hall, while the sessions of the Congress will be held adjoining. The Congress will commence on Monday evening, February 28, with the formal opening of the show, and will end on Friday, March 3, the technical sessions commencing on Tuesday morning, February 29, and continuing on Wednesday, Thursday and Friday.

The City Council of Ottawa have been considering for some time the advisability of appointing a Commissioner of Works who shall be competent also to act as City Engineer, and it is understood they are ready to consider the appointment of such a man. We understand the board has prepared a draft of a somewhat elaborate by-law defining the duties of this official.

New Manitoba Parliament Buildings

Beautiful New Legislative Capitol, Winnipeg, modernly equipped—Built on simple but dignified lines in classic style, based on Greek detail

ONE of the largest public buildings now under construction in Canada is the Legislative and Executive Building in Winnipeg for the Province of Manitoba. Plans for the building were selected by competition open to all architects practising in the British Empire. Conditions for a preliminary competition were published in December, 1911, and sixty-seven sets of sketch plans were submitted in the spring of 1912, from which the designs of five competitors were selected for future competition, an honorarium of $2,000 being paid to each for the preparation of final competition drawings.

Mr. Leonard Stokes, F.R.I.B.A., past president of the Royal Institute of British Architects, acted as assessor, and the five successful competitors in the preliminary competition were: Mr. Frank W. Simon, Liverpool, Eng.; E. & W. S. Maxwell, Montreal; Sharpe & Brown, Toronto; Brown & Vallance, Montreal; Clemesha & Portnall, Regina. The successful design in the final competition chosen by the assessor and confirmed by the Lieutenant-Governor in Council in the fall of 1912 was that of Mr. Frank W. Simon.

The first Parliament of Manitoba was held in 1871, but it was not until 1884 that the Legislative Building at present in use was erected, at a cost of about $285,000. The new Parliament Building is the latest of the modern legislative capitols to be erected in Canada. Its construction became necessary as a result of the inadequacy of the old building due to the rapid development of the province during the last decade.

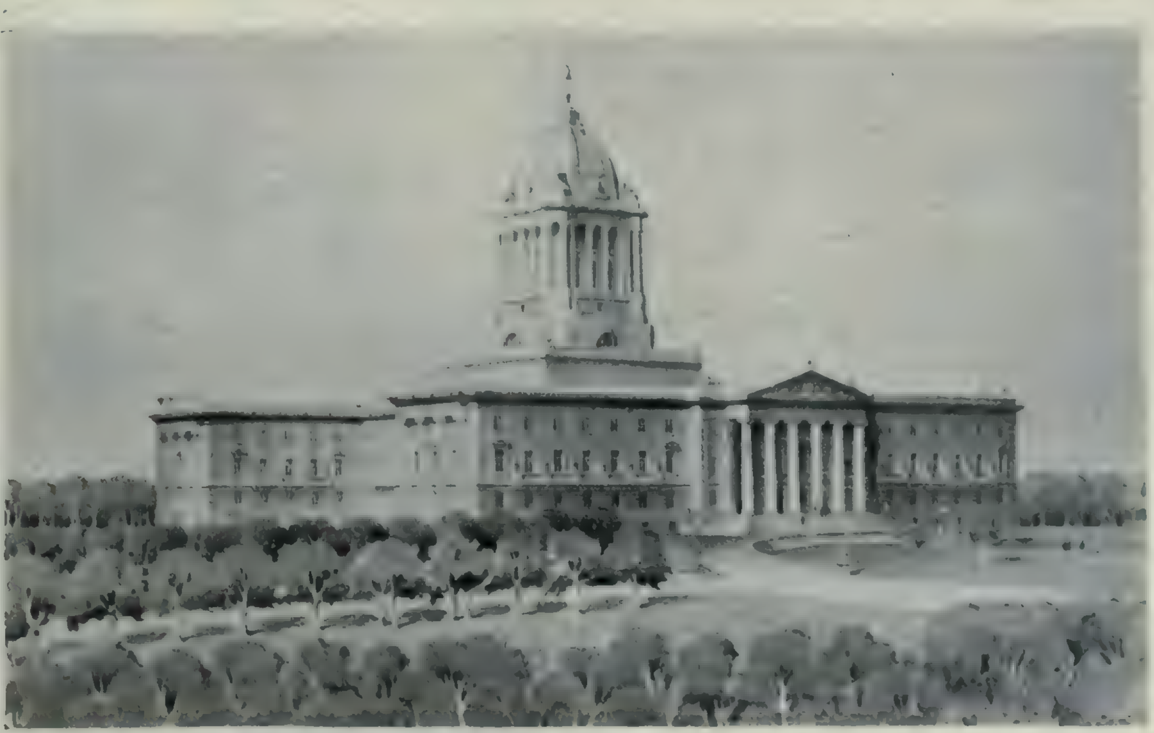
Recent political changes have led to the supervision of the work being placed in the hands of Mr. Frank W. Simon, the original designer of the building, which is a matter of satisfaction to the architectural profession. The construction is now being continued under a temporary contract on a percentage basis by the Jas. McDiarmid Company, Limited, of Winnipeg, until a schedule of quantities can be prepared for the balance of the work, and a new contract will be let for completion.

The plan is laid out on dignified and simple lines and takes the form of the letter "H" contained in a rectangle measuring 337 ft. by 328 ft. The central portion is occupied by the entrance halls, grand staircase and legislative chamber, library, premier's parlor and committee rooms whilst the wings are assigned to the executive offices.

The building occupies a symmetrical site of about thirty acres in area bounded by Broadway and the Assiniboine River, Kennedy and Osborn Streets, and the main facade is set back 350 ft. from Broadway. The site is intended to be laid out in a park-like manner.

The building generally is in the classic style based on Greek detail. The principal entrance faces Broadway under a portico of six Ionic columns supporting a pediment filled with emblematic sculpture. Over the centre of the building is placed a dome 230 ft. high surmounted by a figure in bronze, bearing a lamp which will be lighted when the House is in session.

In the original design the building was to have been supported on reinforced concrete piles driven



Architect's perspective of completed building—Manitoba Parliament Buildings, Winnipeg, Man.

Group of employees—Mr. F. W. Simon, F.R.I.B.A., Architect, shown with cane, is seated in centre of group.

to rock, the dome being placed on reinforced concrete caissons. It was, however, decided by the late Government to carry the whole on caissons, as no reinforced concrete piles had up to that time been driven in Winnipeg, though their satisfactory use to a depth of 70 ft. has been attested in government work in the Old Country. Grillage beams are placed upon the caissons to carry the walls. For the reinforced concrete construction above foundations in the original design, steelwork encased in concrete was substituted and floors have been constructed of concrete slabs reinforced by "Triangle Mesh" reinforcement.

The exterior of the building is faced with local Manitoba Tyndall stone, which, though requiring somewhat careful selection, is a sound building stone displaying much character in color and mottle. Tyndall stone has already shown good weathering quality in many buildings in Winnipeg. Light grey granite will be used for the steps of the four porticos. The finest selected Tyndall stone will also be used in facing the entrance, grand staircase and members' ante halls and surrounding corridors; domes, vaults and ceilings being carried out in French stone (Caen Stone Cement). The Legislative Chamber will be lined to cornice height with Mazzano marble, its vaulted plaster ceiling being decorated in color. Floors of halls and corridors will be paved with varying shades of Tennessee marble enriched with European and Canadian marble inlay. Columns, mantelpieces, dadoes, buses, etc., will also be carried out in various Canadian and European marbles.

The Premier's and Lieut. Governor's rooms, ministers' suites and committee rooms will be panelled in different hardwoods, and hardwood trim will be used throughout the building. A number of the rooms will have parquetry floors, while in the remainder oak or maple will be used. Windows throughout will be fitted with Henry Hope & Sons' (England) steel casement sash and also with interchangeable steel storm sheets and fly screens. Bronze will be largely employed in entrance doors, screens, railings, lamp standards and hardwood. Six electrically controlled elevators will serve the building, two being placed in the centre and one in each of the four wings.

Electrical Equipment

The needs of the building call for a very large connected load over comparatively large areas for lighting and power, and this has led to the adoption of what closely approximates to power house methods; that is, the circuits have been so arranged that the usual switchboard is dispensed with. Feeders are run directly from the two transformer rooms to the riser shafts and from here the distribution is in the usual manner through panel boards to the branch circuits. Electrically controlled switches are used wherever a feeder or riser has its origin, and where special lighting is placed, a board equipped with control switches and indicating devices will be located in the engineer's room. All switching will thus be done from a central point without incurring the expense of the heavy runs of copper consequent on the use of a central switchboard. Two banks of transformers will be connected delta to star, allowing the use of a 4 wire 3 phase system of distribution; the neutral being grounded at all points. The regulation is designed to be not wider than 2 per cent. over the entire system.

A complete system of steam radiation is provided, controlled by thermostats operated by compressed air; washed and heated air, its temperature again regulated by thermostats will also be supplied. A perfectly even temperature of from 60 to 75 degrees as desired will thus be maintained, together with a con-

Manitoba Parliament Buildings--Companion views of north end showing main entrance off Broadway.

tinuous supply of fresh, pure air. Steam will be supplied from the provincial power house by way of a tunnel under Broadway.

Plumbing

Cold water service will be supplied from storage tanks located in the second stage of the dome, hot water being supplied direct from the power house by means of a circulating system so arranged that hot water can at all times be immediately obtained at any fitting. Hot water supply pipes are to be of drawn annealed brass so as to avoid the danger of damage to the system likely to be caused by the soft water with which Winnipeg will soon be supplied. A vacuum cleaning system will be installed at all convenient points. Fire service outlets and hose supplied direct from the mains will be so placed as to control the whole of the building. A private post office and telephone exchange will be provided, and the latter will be supplemented by inter-communicating phones and bell system. Pneumatic clocks controlled by a master clock situated in the central hall will also be provided.

East end of north wing—Manitoba Legislative Buildings.

The work of setting the cut stone and utilizing other materials supplied under the former contract is now proceeding, and in order to avoid delay in continuing the work when a tender for completion is accepted in the spring a contract has been made with the Wallace Sandstone Company, Limited, of Tyndall, for the supply and storage, till required, of cut stone for the interior, and Henry Hope & Sons have been instructed to proceed with the steel casements. The cubical contents of the building are approximately 7,000,000 cubic feet.

The original tender amounted to $2,859,750 exclusive of heating and ventilation, lighting and plumbing, a sum which is generally considered to represent a very low estimate of the value of the work. Figures for the probable cost of the building when completed are not yet available.

List of persons and firms at present connected with the work:—Architect, Frank W. Simon, F.R.I.B.A.; Consulting Constructional Engineer, S. Bylander; Quantity Surveyor, Hugh Watkins; Consulting Electrical Engineer, J. M. Leamy; Consulting Mechanical Engineer, S. S. Kennedy; Chief Inspector, Thomas Wallace; Cut Stone Inspector, P. McKissock; Inspector's Clerk, T. H. Wood.

The contractors under the present temporary arrangement are: The Jas. McDiarmid Co., Ltd. Subcontractors: steelwork, the Manitoba Bridge & Iron Works, Ltd.; cut stone, the Wallace Sandstone Co., Ltd.; electrical work, the Schumacher Gray Co.; plumbing and steamfitting, the Jas. Ballantyne Co., Ltd.; marble, the Marble & Tile Co. of Canada.

Proper Slope for Concrete Chutes

W. H. Ansley, of the engineering department of the city of Indianapolis, writing in Engineering and Contracting, gives some interesting figures regarding the placing of concrete by gravity plant. Their experience has shown that the most satisfactory slope for concrete chutes is one to three, that is, 4 inches of drop to 1 foot of run in making the layout for a concrete gravity plant. Some contractors will carry concrete successfully in a chute much flatter than this, by using a slope as flat as 3 inches of rise to 1 foot of run. Whether or not this can be done is a question of the experience of the crew in mixing the concrete and also involves the character of the aggregates. Concrete of broken stone requires a greater slope than concrete made of round gravel. Also gravel that has a very slight percentage of clay or hydrated lime will carry on a flatter grade than gravel that is thoroughly washed, and concrete that has a larger percentage of cement will flow on a flatter grade than concrete which is lean in cement. The grade on a line of considerable extent, say 200 or 300 feet, should not be uniform but should leave the hopper at a perceptibly slower grade, the grade of the chute gradually increasing toward the end, but the average grade will be about one to four.

Concrete is properly mixed for gravity distribution when all of the aggregates are held in suspension. If there is more water in the mixture than required to hold all of the aggregates in suspension, the concrete will be sloppy and the heavier aggregates will settle toward the bottom, tending to drag on the bottom of the chute, allowing the grout to move faster than these heavier particles and also tending to clog the chutes.

If concrete does not have water enough to hold the particles in suspension the whole mass will be sluggish and will not move properly. Concrete for a concrete gravity plant should be thoroughly mixed. There is only one condition in which the concrete is in proper and best condition to travel in the chute, that is as just stated. When the concrete is properly mixed the grade of the spout will depend on the aggregates as also stated above.

To recapitulate, it is good general practice to lay out a plant with a grade of 1 to 3 from the hopper gate to the end of the chute which will be the highest point of spill. A contractor will find by experience whether or not he can vary from this grade with the operating crew that he has available and the materials which he has to use. In figuring the height of the tower he will require an average of 20 feet above the hopper gate for the height of the hopper and the dumping head room of the hoisting bucket.

A company known as Cleveland, Limited, has been incorporated with head office at St. John, N. B., and a capital stock of $40,000, "to purchase, hold and use a certain secret process, known as the Cleveland Process, for the treatment of metals." and to "sell and deal in metal goods and machinery of all kinds." The incorporators include I. MacDonald, L. A. Barry, J. C. O'Mullin, and G. X. Couture, all of Halifax, N. S.

Improvements in House Sanitation

Houses are built to live in, not to look on — Architects', Builders' and Municipal Authorities' responsibility for disease

By M. T. Cantell, Lic. R.I.B.A.

IN designing and building a house the chief consideration should be the health and comfort of the occupants. The philosopher Bacon once said: "Houses are built to live in, not to look on." This aphorism should be the present day motto, but how far is it so? Beauty of form and color applied to architecture is certainly pleasing to the eye and should be encouraged, it is a contributor to our pleasures, but health and long life take precedence of all things, therefore, objects which tend to produce these claim prior consideration.

Since the early part of the last century much time and money have been spent by scientists and sanitary authorities investigating the cause of disease and of the conditions favorable to its spread. This has resulted in the gain of an accurate knowledge of the nature of many of the most distressing and infectious diseases and of the means to be taken to prevent their spread. It is now general knowledge that cholera, typhoid fever, dysentery and other maladies characterized by diarrhoea are due to micro-organisms which are disseminated in sewage and by various means gain access to water which is used for human consumption and is thereby conveyed to the system.

The breathing of impure air is known to be responsible for a large number of maladies; the nature of which depends upon the degree and natures of the impurities, amongst the most important of these maladies are:—acute asphyxia, headache, prostration, sore throats, lung diseases, diphtheria, measles and fevers.

Cold and damp houses, also deficient ventilation and sunlight are responsible for such diseases as:—pneumonia, consumption, pleurisy, bronchitis and rheumatism. These agents also cause loss of vitality with corresponding reduction of power to resist other complaints.

Pure Water Supply

The necessity of a pure water supply and an efficient system of sewers and sewage disposal has been known for centuries. Even ancient Ninevah had a good drainage system and 300 years B. C. Rome had a very complete water supply and drainage system, also municipal inspectors and medical officers, and many of the residences were far better ventilated than most of our modern buildings. Some had sliding roofs for this purpose, even dining rooms were fitted with ceilings to rise and fall so that the air space could be regulated according to festivities. The Atrium (Hall) which was used as a reception room was also large, well ventilated and splendidly arranged for light.

With the decay of ancient civilization sanitation fell into a deplorable condition. Havoc was continually wrought by plague and pestilence, yet after attention was given to the subject it took centuries to bring about any noticeable improvement. Although legislation was commenced in England during the 13th century to improve existing sanitation and to govern the construction of buildings very little progress was made in any country until about the middle of the 19th century. Since then reforms have been numerous and rapid. The reformers have not directed their attentions solely to drainage and water supply but have also largely improved the general construction and arrangement of dwellings. We now have regulations governing the width of streets: air space at the rear of buildings; a standard for the width of foundations, thickness of walls and floors, also height of rooms and certain sanitary details; laws governing the class of materials to be used for various purposes, and special municipal inspectors to see that these regulations are carried out. But with all these modern improvements in this country we still have an almost endless number of badly designed and disgracefully built houses which are the direct cause of discomfort, disease and death.

Much could be said with regard to our water supplies; town planning; sewage systems; scavenging; pollution of rivers; inspection of food, etc., but these are matters which claim the attention of civil engineers and municipal authorities and are not directly associated with house construction so will not come within the province of this article. Municipal authorities, however, as well as architects and builders, are directly concerned in buildings and are therefore jointly responsible for the disastrous effects of badly designed and constructed dwellings.

Easy Among Well-to-do Classes

Amongst the wealthy classes, where cost is not the primary consideration and the property is for their own occupation, the principles governing the design and construction of healthy houses are only to be known to be applied, consequently, if the work were only placed in the hands of competent architects the result would, generally, be all to be desired both with regard to design and construction. It is, however, to be regretted that a large number of these residences are designed by untrained architects who have no knowledge of sanitary science and no experience in practical construction, consequently, not even the wealthy classes are entirely free from the dangers which so closely beset the poorer community. It is, however, the houses in which the middle and poorer classes live and the conditions under which particularly the latter exists that demands special attention. Certainly in our urban and many rural districts we have building by-laws but many of these are insufficiently stringent to be of much value, others are practically useless through laxity in their operation and some, unfortunately, are allowed to be operated according to personal interests. It is not to be denied, however, that during recent years great improvements have been effected by municipal building legislation which has resulted in a very material diminution of disease and death. It is also satisfaction to know that much is still being done in this respect and also to find that our educational authorities are now waking up to the fact that a knowledge of hygiene is of the utmost importance; principles of this science instilled into the minds of the young will have an invaluable effect upon the future health of the nation. But with all the improvements already effected there is still much to be done especially with the design and construction of dwellings.

Among the numerous existing faults and defects the most serious are:—Stuffy unventilated rooms;

dark rooms; rooms and passages receiving no sunlight; rooms ventilated and lighted from other rooms; low pitched rooms; draughty and cold rooms; overcrowding of living and sleeping rooms, factories and workshops; occupation of basement rooms; cellar storage of food; convenient corners for the accumulation of dust; damp walls and leaky roofs; smells from decaying woodwork; foul gases from defective drains percolating through soil or escaping through untrapped pipes; smells from foul sanitary fittings; fumes from the combustion of fuel and certain illuminants; fixed windows and no means of keeping open those not fixed; construction and position of garbage receptacles; infrequent removal of garbage; damp subsoil and lack of air space around building.

Responsible for Ailments

These defects, which need not exist, are responsible for such ailments as those enumerated under "breathing of impure air" and "cold and damp houses." Now the questions are:—(1) why do these defects occur? (2) how can they be prevented?

Some occur through the desire to execute the work cheaply, especially so in speculation and cutting competition work; others occur through want of skill or practical experience, and some through lack of proper supervision of the architect or municipal inspector, through loosely worded and incomplete municipal by-laws or through ignorance of the public as to the causes of disease and the conditions favorable to its spread. These causes suggest various means of prevention including the following:—by each city appointing a special board consisting of men who are specialists in some branch of building or sanitary science, all branches of each to be fully represented; the board to have unlimited powers to formulate by-laws to govern the construction, periodical inspection and sanitary maintenance of buildings and to appoint medical officers of health and expert inspectors to ensure the due observance of these by-laws. As previously mentioned, we already have municipal buildings committees invested with certain powers in this direction but unfortunately many of these committees partially or entirely consist of men who have no experience whatever in the work appertaining to their duties. Not only is this the case but many inspectors are appointed who have no technical training or very little, if any, practical experience. The writer has heard the statement that it is only necessary for a man to be acquainted with the by-laws and to have an elementary knowledge of building construction to qualify for an inspectorship. In many districts this idea is evidently general.

Architects' Responsibility

Where such conditions as the foregoing exist, progress towards the prevention of disease is severely retarded and the sooner municipal authorities wake up to these facts the better will it be for the health of the nation. Much good would also be derived by regular press publications comparing the statistics of health for different districts, with comments on the probable and known causes of increase or decrease in cases of infectious diseases and in the death rate. This would help to drive home the facts of sanitary science into the public mind and conscience.

The responsibility of architects cannot be overestimated. We must, however, bear in mind that all dwellings are not designed by qualified architects and that a large proportion of the general defects exist in the class of dwellings for which they are as a rule not responsible, notably those of the laboring and artisan classes, but architects are in most cases responsible for the planning of residences of the wealthier classes and of the class of buildings known as apartment blocks. It is the latter in which the most serious faults are prevalent. Most of these buildings are erected for the sole purpose of exorbitant profit and many of them are nothing more than veritable death traps, the chief object being to crowd in as many suites as possible, resulting in mere boxes for rooms, particularly bedrooms, and the whole deficient in the necessary conveniences conducive to comfort and health and in the means necessary to provide efficient ventilation and light. Habitable rooms, even bedrooms, are allowed to exist in the basement which is one of the most flagrant evils of these buildings. It is well known that a basement is the most unsuitable place in a house for the storage of food which is of course due to the greater impurity of the air here than elsewhere; then why should it be a suitable dwelling for human beings?

Surface Only Scratched

Canada was asked for fifty millions, and easily made it one hundred and ten. There is no evidence, either, that the financial resources of the Dominion have been more than merely "scratched." This may be a small "pill," but it will certainly have considerable of a bitter taste for our bankrupt enemies.

Light and Fresh Air

No matter how well a house is built structurally if there is not a bountiful supply of light and fresh air it is far from being fit for occupation. Light, particularly sunlight, is a strong disinfectant and purifier. It destroys the organic poison of infectious diseases. Koch found that direct sunlight killed tubercle bacilli within a few hours and bright diffused daylight in a few days. It is known to have the same effect on many other resistant microbes.

We also know that sunlight makes us bright and cheerful and that it quickens our blood circulation thus making us more resistant to complaints. Several years ago Sir Frederick Treves, the late King Edward's surgeon, when speaking of the disastrous effects of breathing impure air said: "the sun is the cheapest, simplest, most effective germ killer we know."

Every room should be abundantly lighted. Insufficient light is sometimes due to carelessness in planning with regard to aspect and surrounding property, sometimes to the desire to save a few dollars on the installation and running of the heating plant, and in some cases to the desire for the architecture to be in a certain style which calls for low, narrow windows or small leaded lights, which means nothing more or less than a sacrifice of health and comfort for external effect. Semidarkness in any part of a house is inexcusable, however common it may unfortunately be. All windows should be in position and size quite adequate to the work they have to do but an excess in size should be avoided on account of the consequent heat and cold.

Carelessness, style or economy of cost, however, are not always responsible for insufficient light. The architect may provide means whereby an abundance may be obtained in all rooms and passages but as soon as the tenant takes possession the windows are carefully fitted with blinds and partially or entirely covered with dust or we might say, microbe collecting curtains. The latter subdues or partly obscures the light and the blinds are used during the day to shut out the sunlight to save the curtains and carpets from fading. How soon will housewives realize that fading health is a far greater loss than fading carpets, and far more costly than occasional renewals?

A supply of pure air is absolutely necessary for the due preservation of health, and to obtain this it is not only necessary that there should be a due amount of air space about a building but that all parts of the interior, without exception, should be well ventilated. This is one of the chief essentials upon which the healthiness of a house depends. It is, however, one upon which the least attention is paid both by the architect and the occupier. By ventilation is meant a free circulation of fresh uncontaminated air. In how many houses is it possible to obtain this? Especially during the winter when windows and doors are kept hermetically sealed, in most cases for several months at a stretch, and as no other means have been provided for the admission and exit of air the occupants during the whole of this time are compelled to breathe over and over again the foul air robbed of its oxygen, laden with dust, and polluted with the products of respiration, putrescible organic matters given off by the lungs and skin and by carbonic acid, carbon monoxide (one of the most poisonous gases known) and other poisonous gases caused by the combustion, or imperfect combustion, of fuel, coal-gas and other illuminants. The organic matters are known to be the most injurious products of respiration and are the cause of the close unpleasant odor, so perceptible in overcrowded tramcars on a wet day and in ill-ventilated and overcrowded rooms.

Danger of Disease

Breathing air so contaminated is acknowledged to be responsible for a very large proportion of the cases of consumption in our cities as well as other diseases previously mentioned. It is a well-known fact that consumption depends upon the tubercle bacillus and that damp, overcrowding, lack of ventilation and sunlight are the chief factors predisposing to the development of this microbe.

Consumption is also known to be exceedingly infectious, the infection generally being due to persons inhaling air laden with dust containing expectorated bacilli. The extent of this danger can be realized when we think of that. Nuttal estimated that in a moderately advanced case from one and a half to four billions of bacilli were coughed up and expectorated daily, a large proportion of which is liable to be scattered about, dried, and disseminated as dust, in which condition they are known to retain their vitality for several months. From this and what has been said it is obvious that sunlight and a free circulation of pure air will largely reduce the danger of infection from this cause, therefore no trouble or expense should be spared in securing these essentials. If the means do not exist it is due to the neglect of the architect who is therefore responsible for the consequences.

Next to ventilation probably the most important items requiring attention are, faulty drainage, improper and defective sanitary conveniences and fittings. Faults and defects in this work are numerous and are responsible for the escape into the house of sewer air which is well known to be an important factor in the causation of such diseases as typhoid and puerperal fever, pneumonia, phthisis, diarrhoea, sore throat and diphtheria, headache, vomiting and prostration.

It may be contended that sewer-air does not contain the micro-organisms to which these diseases are due. That is so according to the result of experiments, which have not yet been disproved, by such authorities as Miquel, Carnelly, Haldane and Laws who found that the number of bacteria in sewer-air is actually less than in fresh air at the same time, and very much less than in the air of unoccupied houses; also that micro-organisms in sewer-air are related to and probably derived from those of the fresh air and have no relation to those contained in the sewage. Further more, there appears to be no proof that sewage gives up bacteria to the air; it therefore appears at present to be an unsolved question as to what is the real cause of the deleterious effects of sewer-air; various authorities have suggested that it is due to an obscure alkaloidal poison by some means generated in this air. There is, however, no proof of this; but whatever the cause, observed facts prove beyond doubt that the presence of sewer-air in the house is one of the most serious dangers possible to exist and is well known to predispose such diseases as mentioned and to render them more severe when they occur. To convince us of this we have only to study the mortality statistics of important cities particularly in England, Germany and France, where the reduction in the death-rate known to be due to improved house sanitation is simply amazing.

Sewer-air may enter the house by escaping through broken or leaky drainpipes and finding its way through the soil into the cellar or open windows or by escaping direct from the drains through untrapped air in the soil can force its way into a warm house sanitary fittings. It is well known how easy impure even through stone walls and concrete floors.

Drains with broken pipes, leaky joints and defective or no traps are far more numerous than is generally believed. What would be revealed in this respect if it were possible to obtain an open view of the entire drainage of the houses in some of our towns would be appalling.

Such conditions are chiefly due to either the carelessness or the inexperience of the builders. The former is usually the result of the desire to erect the building as cheaply as possible which is a consideration often outweighing the honor and duty of the builders to their clients or prospective tenants.

Enforced Inspection

The only remedy for this lies in the power of municipal authorities who should enforce the use of first class materials and details of approved design for their respective purposes: They should also carefully examine the foundation upon which a drain is about to be laid; inspect and thoroughly test all parts of the drain before the excavation is filled in, then again when the building is complete and quite ready for occupation and at subsequent intervals of about five years. The water test should be applied to all parts of the drain and the smoke test to all vent pipes and fittings. No portion of the work should be passed until the whole system is absolutely perfect. It is only by this means that we can expect a further reduction in the maladies caused by imperfect house sanitation.

The First Church of Christ, Scientist

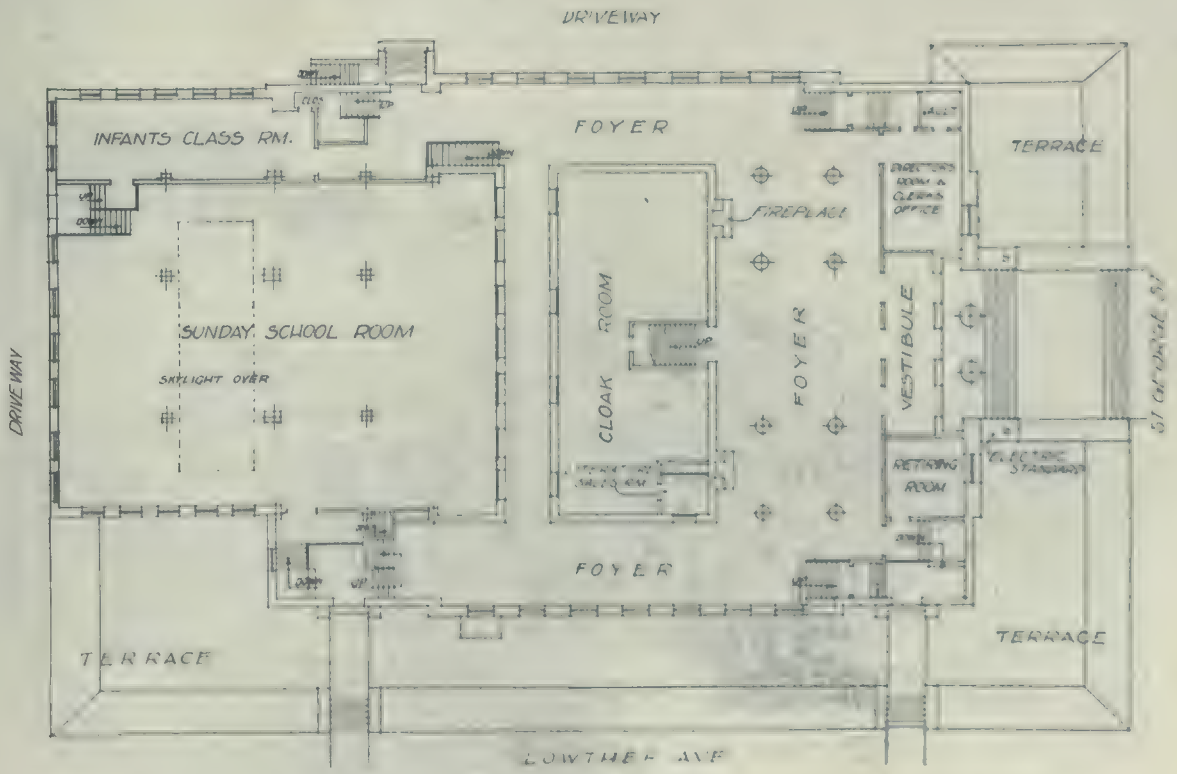
Beautiful new edifice, corner Lowther and St. George, Toronto—Pressed brick with artificial Stone facings—Greek Doric Style of Architecture

THE new First Church of Christ, Scientist, located on the north-west corner of Lowther Avenue and St. George Street, Toronto, is rapidly nearing completion. This new edifice is built of pressed brick with artificial stone facings, based on the Greek Doric style of architecture. The building is set well back on the site, thus allowing for a beautiful terrace 195 feet in length on Lowther Avenue and 150 feet frontage on St. George Street. The main entrance faces St. George Street, with two side entrances off Lowther Avenue. The erection of this handsome building will add strength and beauty to the already beautiful district of Lowther Avenue and St. George Street. The Sunday-school and the foundations for the main body of the church were completed a year ago, and the church proper is now almost ready for occupation. The Sunday-school in the meantime has been used for church services. It has a seating capacity of approximately 650 persons.

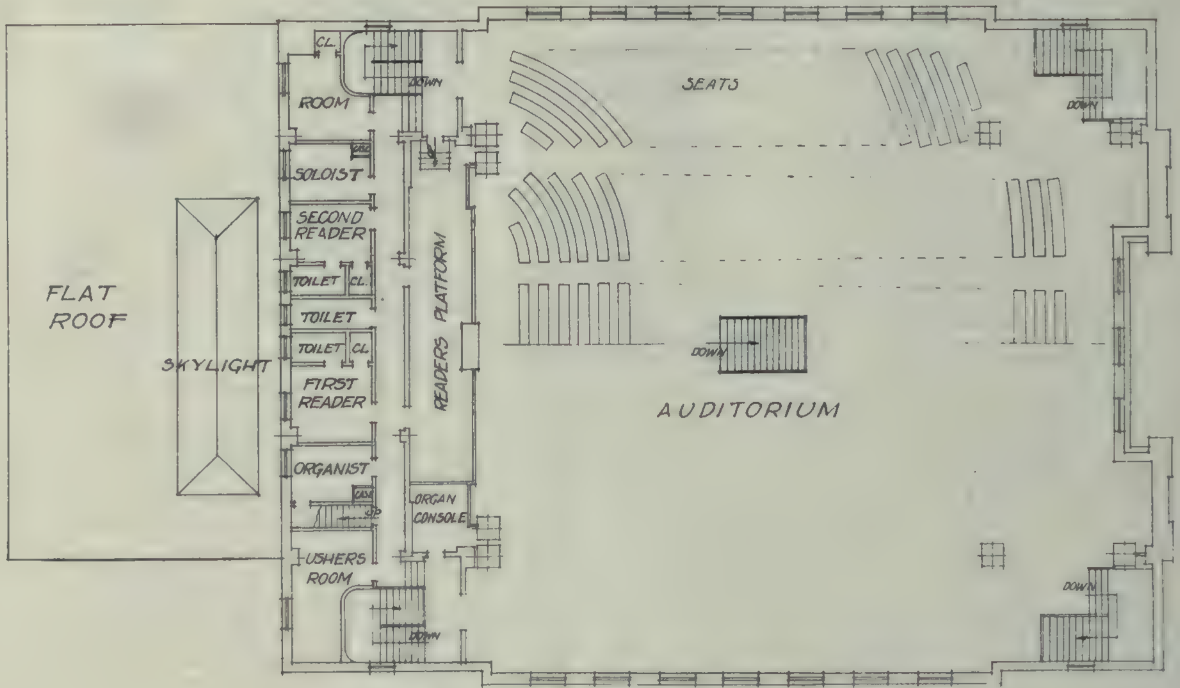
The main entrance on St. George Street consists of three separate doorways, divided by two immense Doric columns of artificial stone. A flight of wide cement steps, with a cement walk of the same width, leads up to this entrance. On each side of the main entrance will be placed black ornamental iron standards for electric lighting,, each standard carrying 400 watts. The Doric columns are good samples of the degree of excellence which the artificial stone manufacturers of Canada have attained in their work. Surmounting these columns is a frieze and an entablature of the same material, with the name of the church in raised letters on the frieze. Behind the columns are three outer doors entering into a vestibule, from which three corresponding doors give access to a large assembly room called the main foyer.

The level of this main foyer is about 4 ft. above St. George Street. Off the main foyer, which runs the full width of the buildings, is a ladies' retiring room, on the south-east corner; the directors' room and clerk's office, in the north-east corner; a wide cast-iron staircase with mastic treads, leading to the centre of the auditorium above, from directly in front of the main entrance; also cast-iron staircases ascending to the auditorium floor, from the main foyer in the north-east and south-east quarters. On each side of the central staircase in the main foyer is a gas-log brick fireplace. On the north and south sides of the building are side foyers, giving access to the cloak-room, literature sales room, and, by staircases, to the Sunday-school.

It will be noted that this church is designed with the idea that members may first intermingle socially in the large main foyer, which will accommodate about two thousand people. The side foyers lead to the cloak-room, which has sufficient accommodation for one thousand people. The actual service is held in an auditorium above, the floor of the auditorium being about 13 ft. 6 ins. above the level of St. George Street.



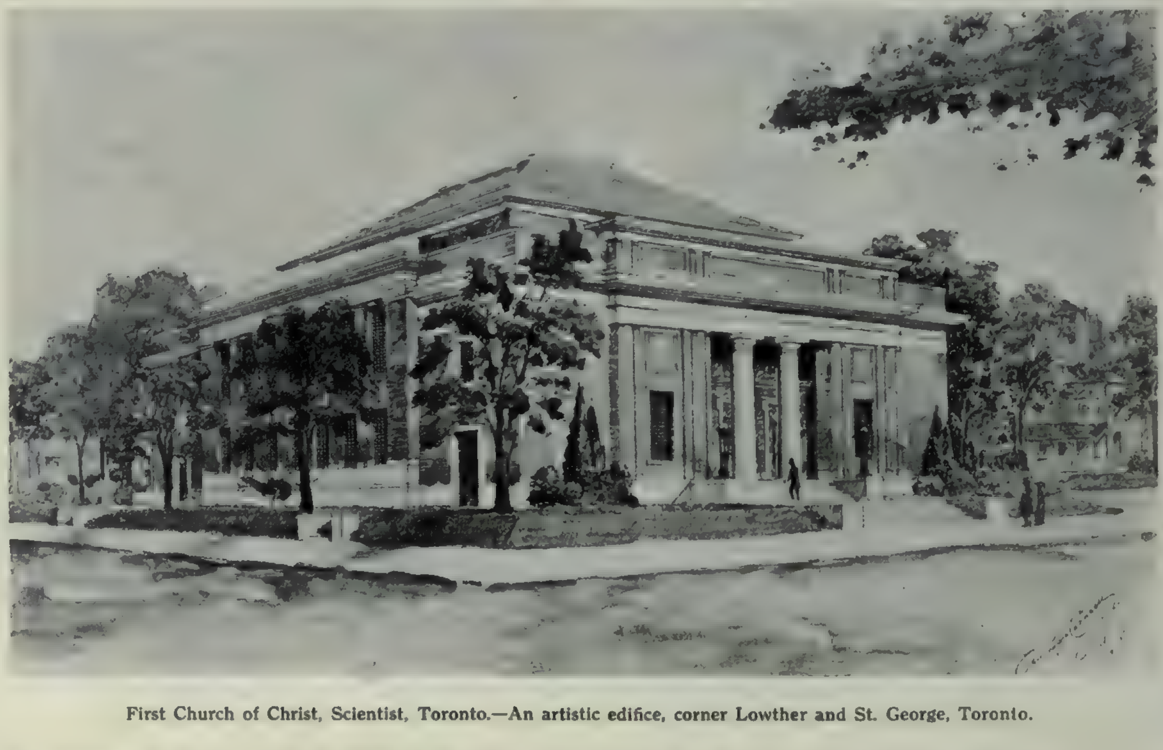
Plan of foyer floor and Sunday School.—First Church of Christ, Scientist, St. George and Lowther, Toronto.



Auditorium plan.—First Church of Christ, Scientist, Toronto.

The whole layout of the building is thus designed with a view to providing every accommodation for social intercourse among the members.

The auditorium, or church proper, will seat about one thousand people. This space is entirely free from supports or supporting columns which might obstruct the view, except for two main pillars in the rear which carry the roof. This excellent arrangement has been rendered possible by supporting the main roof on four main steel columns with trusses spanning from column to column. The longitudinal trusses are 68 ft. long and 10 ft. 6 ins. deep; the transverse trusses are 57 ft. long. The walls of the building carry practically only their own weight, and a portion of the auditorium floor weight. This arrangement gives an unobstructed view of the reader's platform from the



First Church of Christ, Scientist, Toronto.—An artistic edifice, corner Lowther and St. George, Toronto.

whole auditorium. The seating plan is such that all members face the reader. The middle section of the seats for a space of about 35 feet has a pitch of 1 in 10, while the front 35 feet and the rear 17 feet are level.

The reader's platform is 2 ft. 6 ins. above the low auditorium level and occupies a space of about 42 ft. by 8 ft. Back of the reader's platform, and on the same level with it, are retiring rooms for the first and second reader, organist, soloist, and ushers. On this floor, also, is the blower room for the organ ;to the right of the speaker's platform is the console board Directly above these rooms is a spacious organ chamber 51 ft. long, 15 ft. wide, and 17 ft. high. The organ is to be four-manual, with an echo, and will cost about ten thousand dollars. In connection with this organ no pipes will be seen, the design of the building calling for eight massive columns behind the reader's platform, with open grill-work between the columns, behind which the pipes will be placed and through which the sound will penetrate.

The main roof, which is supported on four steel columns, as already stated, is slate, with a gravel ditch roof. In the centre of the roof is a sky-light of ribbed wire glass. Directly below this sky-light is an artificial light chamber closed on the lower side by horizontal diffusing glass plates and equipped with powerful electric units. Sufficient space is left around these latter plates, however, for ventilation, the air escaping through Louvred openings in the main sky-light.

Sunday School

Access to the Sunday-school is by the north and south foyers down a flight of stairs. The Sunday-school, including the infants' class-room, is about 73 ft. 4 ins. by 75 ft., and 21 ft. 6 ins. high, with a flat sloping roof supported by six columns. Light is furnished by six indirect electric fixtures supplemented by a sky-light of obscure glass in the roof. There are two extra entrances to the Sunday-school on the west. The infants' class-room is on the same level as the foyer floor, and about 10 ft. above the level of the Sundry-school. The boiler room and men's toilet room are beneath the infants' class-room, on the same level as the Sunday-school.

The Sunday-school and infants' class-room have wood floors, with chair-rail and base trim; the foyer, ceramic tile floor with marble base; the vestibule, mosaic tile floor. The ladies' retiring room and directors' room have wood cornices, picture mould, chair-rail, and oak floors. All staircases are steel, with mastic treads and wood handrails.

The interior decorations of the auditorium will be white plaster finish. The whole effect will be massive and handsome, due largely to the pilasters and heavy cornices. All the interior trim, seats, and reader's platform will be birch-mahogany finish. The exterior walls are of pressed brick lined with an interlocking tile, while the ceilings and cornices are built with metal lath and plaster. The window sashes are wood, with concrete casements and sills. Leaded art glass is used throughout, with the exception of the sky-lights.

The following list of sub-contracts for supplies were awarded in connection with this building:—Stone, Toronto Ornamental Stone Company; steel. Dominion Bridge Company, Limited; plumbing and heating, Purdy, Mansell, Limited; sheet metal, A. Matthews, Limited; mill work, Hancock & Charters; painting, A. E. Walker; building tile (Denison), Sun Brick Company, Limited; wiring, Bell Brothers, Weston; plaster, P. J. Hynes; cut stone, Nicholson, Curtis & Vick; ornamental iron work, including electric standards, Ornamental Bronze & Iron Works; marble and tile work, interior, Marbles and Tiles, Limited; face brick, Scott, Hammond & Pratt, Limited. The Dickie Construction Company, Ryrie Building, had charge of the entire construction work. S. S. Beman was the architect. Mr. Thomas Young was superintendent in charge of the work throughout.

Concreting Highways in Winter-time

Some Constructional Methods re Concrete Roads During Freezing Weather—Illustration Shows Canvas Covering Used with Success

By H. Colin Campbell*

WITHIN recent years experience has proved the possibility of successfully carrying on many classes of concrete construction during cold weather. This has been made possible by the discovery and application of such precautions as heating the sand, gravel or broken stone and water so as to give the concrete mixtures a temperature of from 70 to 80 degrees when placed, then quickly protecting the mass in the forms as soon as deposited so as to prevent the possibility of freezing for at least forty-eight hours.

Carrying on concrete highway or street construction during the fall months when low temperatures prevail is, however, quite a different proposition, and one which generally should be avoided. Nevertheless, during the fall months very mild days alternate with cold nights perhaps accompanied by frost or a freeze, and it sometimes seems necessary or desirable to continue working on a pavement job to finish a short stretch to fulfil a contract. Under such conditions it is possible to place concrete providing certain precautions are rigidly observed.

Methods of Protection

During the summer months prevailing temperatures generally average about 65 degs., and for the proper hardening of the concrete pavement a protective layer of moist earth on the concrete, kept moist by frequent sprinkling, is recommended as a moisture-retaining covering to assist hardening under favorable conditions. Such protection prevents rapid evaporation from the concrete and is in large part a guarantee that work will have a successful outcome—mixtures and methods of placing having been what they should be.

During the fall damp or rainy and cool weather is common. Under such conditions the concrete loses less moisture by evaporation than when days are warm and clear. Then the protective earth covering may frequently be omitted, although sprinkling during the day may be advisable. However, the cool nights require that certain precautions be exercised to prevent the damage that is almost certain to occur from freezing if this should take place before the concrete has had sufficient time to harden. Sprinkling during the day when temperatures reach a summer mean, should be frequent enough to keep the surface moist. The color of the concrete surface will disclose to the experienced eye whether the concrete is drying out too rapidly.

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*Engineering and Contracting.

If a frost or freezing weather may be expected, which can be anticipated quite accurately by obtaining Government weather forecasts, then no sprinkling should be given to the pavement during the day. When possibility of frost or freezing seems imminent, a protective housing or covering of canvas should be laid over the concrete. The contractor should provide himself with sufficient canvas to cover one day's work at least. Building paper tacked on slat frames a few inches above the pavement surface can be used, but in case of wind or storm such covering is likely to be torn loose and leave the pavement unprotected, to say nothing of resulting in a loss of the covering material, thus preventing its further use. Therefore, a supply of canvas will be found by far more economical.

Road covered with canvas to prevent freezing.

During the day the canvas covering should be removed as soon as the temperature has gone above the freezing point, and if it should rise to summer mean, then a sprinkling may be given the concrete, as already described. If on the second night it becomes necessary to cover the concrete again to protect it from freezing, a 3-inch layer of straw or similar covering may be applied. A little earth may be thrown on top of the straw to prevent it from being blown away.

Most specifications provide that if prevailing temperatures are likely to be 35 degs. F. or below, mixing water and aggregates must be heated and necessary precautions taken by placing protective covering, to prevent freezing for at least ten days. This provision in specifications aims to direct the method of carrying on work when the temperature falls to 45 degs. or does not rise above 50 degs., and when freezing may be expected each night or may continue for several days. It is quite necessary to secure an interpretation of the specifications that will make possible the enforcement of all measures to protect the concrete from injury.

Concrete pavement construction should not be advocated during the fall when temperatures are variable, and under no cases when the prevailing temperature is around 35 degs., with the exception that if materials are heated it would be permissible to lay a short strip or section to complete a certain contract. Another objection to continue concrete paving under the conditions described, is the uncertain and variable increase in cost involved to thoroughly safeguard the work. Yet the possible increase in cost, especially where only a small section of a contract remains to be completed, would be less than the loss that would be suffered if, through neglect of proper precautions, the contractor could not collect on the work done or had to tear out and replace imperfect work.

Effect of Freezing

Freezing of freshly placed concrete will eventually cause a surface scaling that will render the work unsightly even though doing no greater damage; but there is always the possibility that strength also will be impaired. No attempt should be made to control the freezing point of the concrete by introducing salt or chloride of lime into the mixing water. This does not accomplish the desired end, which is to hasten hardening under favorable conditions rather than to lower the freezing point of the concrete. In no case should concrete be deposited upon a subgrade containing any frost.

Sometimes where there is a boiler plant on the job and it is possible to obtain a supply, steam may be turned in between the pavement surface and canvas covering thus maintaining warmth and moisture, consequently contributing to the progress of hardening. With a watchman on the job, such protection can be kept constant during the night.

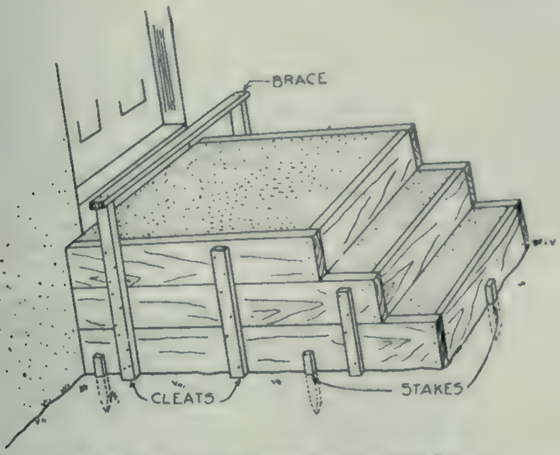
Finally, it should be remembered that concrete gains strength more slowly during protracted spells of low temperatures than under summer conditions. Concrete pavements must be closed to traffic for a longer period of time when the concrete has been deposited during cool days than is necessary during favorable weather conditions. Sometimes, however, there is considerable pressure brought to bear to have a road thrown open to traffic, especially in the case of a much traveled highway or main thoroughfare which when out of commission causes considerable inconvenience. It may be possible, after having kept traffic from the road for thirty days, to cover the concrete with three or four inches of straw or similar cushioning material, then apply a layer of several inches of soil so the abrasion and shocks of traffic will not be communicated to the pavement. This treatment, however, cannot be counted upon to eliminate the possibility of injury likely to result from dense traffic and from heavy loads. Under such conditions there is considerable liability that the pavement will crack, not having developed its full strength. Opening concrete roads to traffic too soon has been identified as the cause of occasional failure, and, during the unfavorable conditions of fall, concrete cannot be expected to gather strength very rapidly, hence all desirable precautions should be selected and exercised to the utmost.

Well Done Saskatchewan!

During September, October, and November more than one hundred and thirty million bushels of grain were shipped from the single province of Saskatchewan, with plenty more to follow. Looks like good bank accounts for that province for some time to come—and a full dinner-pail for the Empire.

Simple Concrete Step Construction

Steps are not only subject to hard usage, but when constructed of wood with the lower part in contact with the ground and subject to alternate wetting and drying, decay is very rapid, making them unsafe and dangerous. Steps at the rear or kitchen entrance of the house encounter especially hard usage, but it is a very easy matter to have them durable and safe by constructing them of concrete. A simple method of doing this is shown in the accompanying drawing. The three forms consist merely of that many boxes open at top and bottom and also at the end adjoining the door-sill.



Simple Forms for Constructing Concrete Steps.

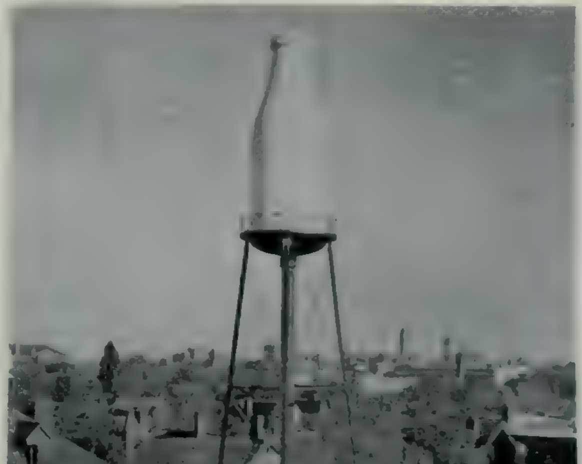
A rise of 8 inches and a tread of 10 inches will be found convenient. For this reason the height of each box should be 8 inches, since every box will form a step. All of the boxes should be of the same width, but each one is 10 inches shorter than the one beneath it, thus forming the treat of the step. If the steps are few in number and not too wide, 1-inch boards will be stiff enough to hold the concrete without bulging, but if there is any doubt about this it is better to use 2-inch plank. The concrete for the steps should be mixed in the proportion of 1 bag of Portland cement to 2½ cubic feet of clean coarse sand to 4 cubic feet of crushed rock or pebbles. The earth beneath the steps should be excavated to a depth of 6 inches below the surface, the excavation being the exact size of the bottom of the steps. Make sure that the earth is level and compact at the bottom of the excavation. Place the largest box in position around the edge of the excavation, staking it in place at two or three points to prevent shifting. Level the first box very carefully by means of a carpenter's spirit level. The concrete, mixed rather dry, should be deposited in the box and thoroughly tamped and compacted until moisture rises to the surface. Work or spade the concrete thoroughly along the sides of the forms so as to produce a smooth surface. At the front end of the box, where the concrete becomes the tread, the surface of the concrete is carefully levelled off and smoothed with a trowel for a distance of about twelve inches from the outer edge. Immediately after this is done the second and smaller box is placed on top of the first one, being fastened thereto by a few nails through the upright cleats shown in the drawing. The nails must not be so long as to project through the forms and into the concrete. Fill the second box with concrete immediately, being careful that no dirt or other foreign matter falls or collects on the surface of the first batch of concrete, as this would prevent a good bond between the two layers. Finish this step or slab in exactly the same manner as described for the first step. The last or third step is constructed in exactly the same manner as those previously described.

The brace between the two back cleats is for the purpose of preventing the boards from spreading at the side next to the wall. The outer surface of the top step is carefully levelled off with a straight-edge and finished by troweling to a smooth surface. Excessive troweling, however, must be avoided.

A Novel Industrial Advertisement

Though we hear much at the present time of two very important factors in the successful operation of every industrial concern, viz., good advertising and good fire protection, to a Canadian concern belongs the credit of combining the two in a very effective manner.

Wishing to install a thoroughly first class source of water supply for their plant in Toronto, Ontario, the City Dairy Company of Toronto conceived the unique idea of building a large symbol of their business to serve this purpose. The "Milk Bottle" tank shown has recently been completed by the Canadian Chicago Bridge & Iron Works of Bridgeburg, Ontario and Chicago, Illinois, who make a specialty of building steel tanks for water and oil storage. The tank shown has a capacity of 25,000 gallons, is 13 ft. in diameter, 35 ft. 9 in. high and is elevated with its bottom 70 ft. above the ground.



"Milk Bottle" Water tank.—City Dairy Company, Toronto.

The purchasers have expressed their complete satisfaction with the work in every sense. In the matter of outline, relative proportions and absolute tightness, it resembles very closely the standard quart milk bottle, which was used as a model by the designers. In all probability there will be considerable development in this new phase of the advertising and fire protection situation, or rather in this particular combination of the two. With the adoption of this idea by other industrial concerns, we may yet see novel shapes to which the water tank of old will lend itself.

The Increasing Use of Wood Blocks

for street pavements—Experience shows long life and low maintenance—Canadian woods better and cheaper

RAPID strides in the use of wood blocks for street paving have been made within recent years in the large cities of Europe and the United States. The same is true to an appreciable extent in Canada, and there are indications that the use of this kind of pavement will become increasingly popular. Canadian woods appear to be perfectly suitable for this class of pavement, especially the Canadian red pine.

Some of the more recent installations in Canada are illustrated herewith. Fig. 1 represents a creosoted wood block pavement on Terauley Street, Toronto, recently installed. Fig. 2 is a similar pavement on Bloor Street, Toronto. Fig. 3 is a portion of King Street, Hamilton, Ont.

The data given in Table I. indicates that within the last two or three years our engineers and municipalities have been paying greater attention to this class of pavement.

Table I.

	In Use	Laid In	
	1900 to 1912	1913	1914
	Miles	Yards	Yards
Hamilton	3	44,473	20,000
Toronto	8.77	25,783	30,900
Ottawa	.41	2,640	22,000
Vancouver	22.3	10,587	27,268
Berlin	...	.....	11,900
Peterboro	...	.....	4,000
Sherbrooke	...	.....	9,000
Welland	...	.....	6,280

Some of the advantages advanced by advocates of block paving in preference to other types are the following:—

(1) Wood blocks have all the smoothness of asphalt without any of the holes and depressions in the surface. On a wet day, asphalt collects and holds pools of slush. A well laid creosoted wood block pavement never develops these depressions.

(2) Water settling in depressions in asphalt rots the asphalt gradually and the hole grows worse. Creosoted block, having been waterproofed, is not similarly affected.

(3) The effect of the heaviest traffic on creosoted wood block is to compress the wood, possibly one-eighth of an inch, into an even tougher, stronger surface. There is almost no wear at all, consequently any dust to be found upon a wood pavement comes from outside sources. The wood, of itself, creates no dust. The method of laying obviates brooming or splitting.

(4) There is no creeping and rolling as is the case with asphalt, consequently the contour of the wood pavement remains unchanged and perfect.

(5) Any brilliant pavement, such as brick or stone, granite, or Belgian block pulverizes and grinds under traffic. Stone blocks, for instance, though specially roughened when new, soon wear smooth and then become rounded. No further evidence of this fact is needed beyond the noise and racket of heavy traffic on such pavements.

(6) All the great "show" thoroughfares of Europe and America are paved with wood block, not only because of the attractive appearance of such pavement, but because of the noiselessness. In Paris, for instance, we find the Champs Elysees, Place de la Concorde, Rue de Rivoli, Rue de la Paix, Place de l'Opera, Boulevard Haussman, etc., paved with wood block.

(7) In London, wood pavements are almost everywhere in evidence on the main thoroughfares, such as the Strand, Oxford Street, King William Street, Queen Victoria Street, and the long, efficient service rendered by these pavements has confirmed the belief that creosoted wood block paving is the most durable of all pavements, and certainly the quietest.

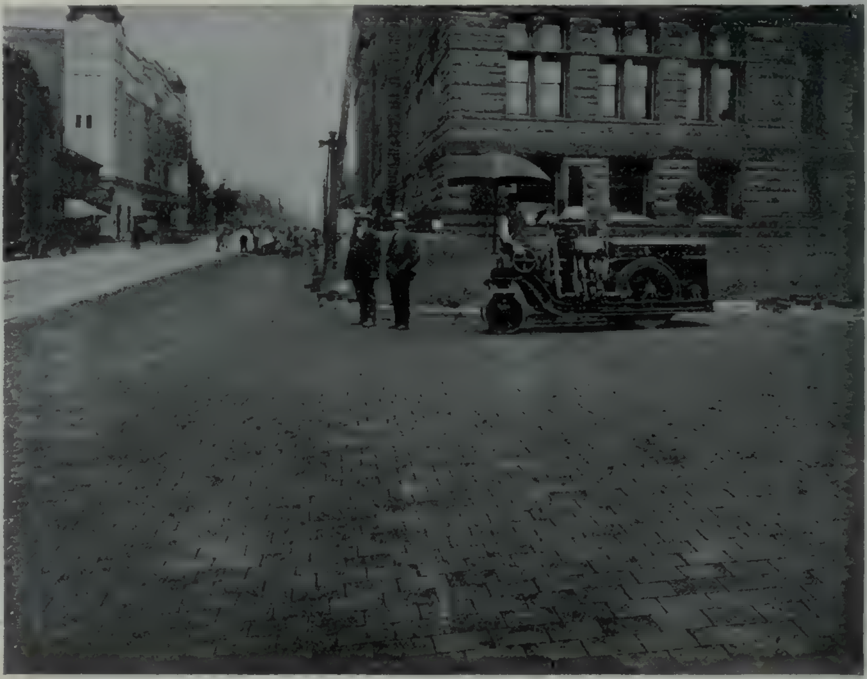


Fig. 1.—Creosoted wood block paving on Terauley street, Toronto

(8) Asphalt cannot be laid satisfactorily close up to street car rails for two reasons. First, the vibration of passing cars breaks and turns up the edges of the asphalt. Second, in the small crevices so formed, wagon wheels grind down and make the ruts wide and deep. Wood blocks can be, and are, laid right close up to the tracks and give good service in this position.

Asphalt, in summer time, softens very considerably, as is evidenced by the surface being very easily indented with the wheels of heavy traffic and with the horses' hoofs, and instead of offering low tractive resistance, it "pulls." This was proven in the series of tests conducted a few years ago by the Works Department of the City of Toronto.

The following extract is from a report made by Dow & Smith, of Boston, consulting, inspecting, and testing experts on pavements:

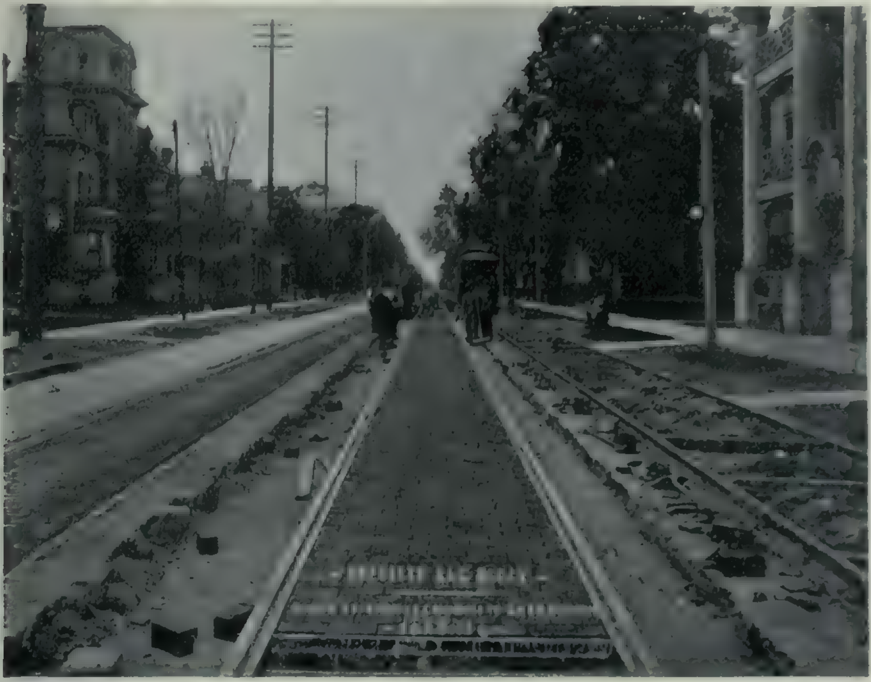


Fig. 2.—Creosoted wood block paving on Bloor street, Toronto

"Probably the oldest pavements in this country laid with creosoted wood blocks of the type now in use, are in Boston, on Tremont and Boylston Streets, which have recently been inspected with the following results. Both these streets were laid in 1900.

"Tremont Street, which carries a heavy traffic, was divided in half longitudinally, one side being laid with sheet asphalt, and the other, concurrently, with creosoted pine blocks, both halves being thus subjected to the same traffic.

"The half of the street paved with asphalt has had extensive repairs, and is at present in bad condition, numerous holes having developed. The pavement was originally laid three inches thick, composed of one-and-one-half inches of binder, and one-and-one-half inches of wearing surface, and the wearing surface is worn down in many places to less than one-half inch in thickness.

"A straight edge laid upon the wood blocks where they adjoin the asphalt, both having been laid originally to the same grade, shows a difference in level of approximately three-quarters of an inch, proving that the asphalt has worn down that much.

"This difference added to the average thickness of the remaining asphalt pavement would show that the wear of the blocks has been practically nil. The condition of the blocks themselves confirms this, as even where the pavement is practically grooved by separating the blocks, the tops of the blocks show no brooming whatever.

"To all appearances, these wood blocks in Boston, although subjected to severe traffic for the past nine years, are practically as good as the day they were put down. There has been no maintenance cost whatever during the nine years the pavement has been in place.

"The asphalt, on the other hand, has been repaired to an extent involving the replacement of from twenty-five to fifty per cent. of the original area of the pavement, which is what would normally be expected under the prevailing traffic conditions with an asphalt pavement laid in accordance with the best modern practice."

That the experience of other large cities on this continent is similar to Boston is shown by the following table (Table II.).

In connection with the best wood to use for block pavements, the Canada Lumberman, in a recent issue, points to the advantages of the Canadian red pine, which, it states, should be used exclusively in Canada. One reason given is that the cost of this wood is lower than United States woods can be laid down for in Canada, and another reason is that the experience in England, according to Mr. H. R. MacMillan, special trade commissioner sent to England by our Department of Trade and Commerce during the present year, is to the effect that the wood that is found to give greatest satisfaction in Great Britain is a Swedish and Russian red wood, which is closely analogous to the Canadian red pine. This report also states that Canadian spruce laid on the north side of Trafalgar Square, London, twelve years ago, with an eight-pound treatment of creosote, is still in excellent condition. The Canada Lumberman also states that the Forestry Branch of the Department of the Interior at Ottawa have issued a bulletin dealing with treated wood block pavements, and are at present engaged in making further investigations. This subject is of considerable interest

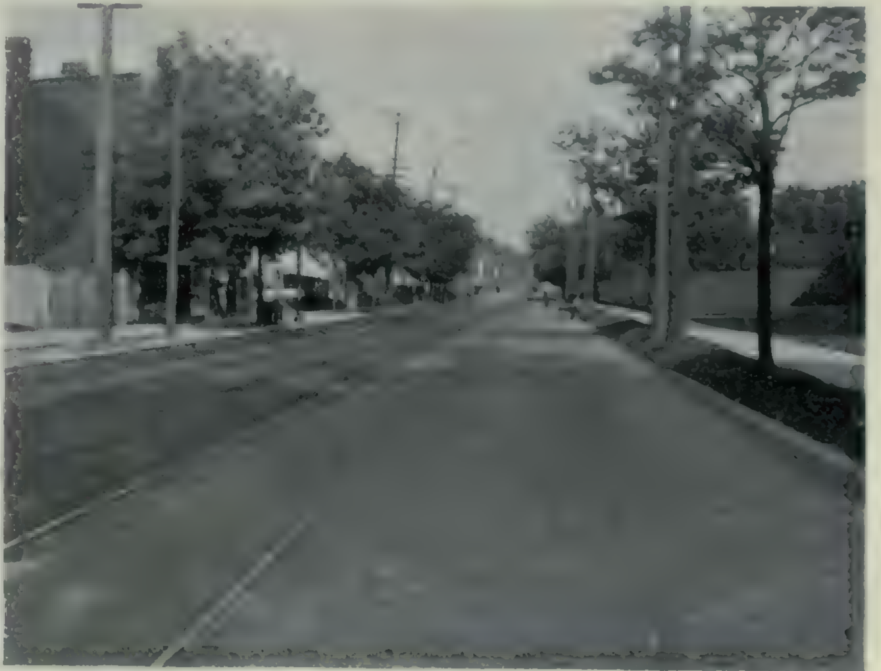


Fig. 3.—Creosoted wood block paving on King street, Hamilton, Ont.

to city and town engineers at the present moment, when the question of better roads is receiving such close attention. The question of lower maintenance is one of the most important features of the discussion.

Table II.

	Square yards of Creosoted Wood Block
Toronto has laid since 1909	122,000
No repair bills to date.	
Hamilton has laid since 1907	285,000
No repair bills to date.	
Greater New York City has laid since 1902	1,635,849
No repair bills to date.	
Chicago has laid since 1902	1,567,027
No repair bills to date.	
Minneapolis has laid since 1903	1,232,814
No repair bills to date.	
San Francisco Dock Department has laid since 1907	198,327
No repair bills to date.	
Boston has laid since 1900	567,982
No repair bills to date.	

Electro-Thermal Smelting of Iron Ore

The Department of Mines of Canada have just issued a report on the electro-thermic smelting of iron ores in Sweden, prepared by Alfred Stanfield, D.Sc. Dr. Stanfield visited Sweden during June and July of 1914 for the purpose of inspecting the principal smelting plants, and met many engineers and other men well informed in regard to electric iron smelting.

Dr. Stanfield's report states that there are two main types of electric furnaces for smelting iron ores:—

(1) The Elektrometall furnace, in which the ore is preheated and partially reduced in a shaft before it reaches the smelting chamber; the heating of the ore in the shaft and the chemical reduction of the iron in the ore are materially assisted by the circulation of the furnace gas.

(2) Furnaces of the Helfenstein, Californian and Tinfos type, in which there is no provision for preheating the ore. Any shafts employed are merely for the purpose of introducing the ore charge conveniently, and the main object of the design is to obtain a large and substantial furnace for smelting iron ores electrically.

In Sweden the first type of furnace has been largely used, and is in regular commercial operation, but experiments are now being made with a modified Helfenstein furnace. In Norway the Tinfos furnace is in operation on a moderate scale.

The Elektrometall Furnace

The report does not contain a minute description of this furnace, which has been described by various writers. The crucible is circular and provided with one tapping hole from which both the slag and the metal are withdrawn. The metal and slag are separated by a dam as they flow, the metal being cast into pigs or taken in a ladle to the Bessemer converter or the open-hearth furnace. The crucible is lined with fire-brick, and not, as in the earlier furnaces, with magnesite. The stack of the furnace is constructed in a steel shell and is supported on steel beams independent of the crucible.

The electrodes are circular, about two feet in diameter, and four or five feet long. The electrode holders consist of two inclined guides between which the electrodes lie supported by guide rollers. At the bottom of these guides is a water-cooled collar, supported from above and packed around the electrodes with asbestos supplied with three-phase current from three transformers. The electrodes do not as a rule need attention oftener than once in two or three days. The circulation of the furnace gas is an important feature in this type of furnace. The gas is withdrawn from the top of the furnace, passed through dust-catchers, and then through pipes, where it meets a water-spray. It is then passed through a centrifugal fan, also supplied with a water-spray, and finally through a drying chamber for the removal of the entangled water.

The Helfenstein Type

The best-known example is the furnace built by the Noble Electric Steel Company at Heroult, California, U.S.A. This type of furnace consists of a large smelting chamber, usually rectangular, having a number of vertical electrodes which enter through the roof. The ore is introduced through a number of chutes, but, as already noted, no attempt is made to preheat the ore before it enters the smelting chamber. The economy obtained by the large shaft and efficient gas circulation of the Elektrometall type of furnace is deliberately abandoned in the Helfenstein type, attention being centred rather on the provision of a large and substantial smelting chamber in which the smelting can be carried out rapidly by electric energy. The economy of this type of furnace increases with the amount of power employed. It is estimated that by building a furnace to use 12,000 h.p. instead of 4,000 h.p., an increase in economy may be obtained which will offset the loss due to the absence of a preheating stack.

Electric Iron Smelting in Sweden

Under this heading the report states that the electric iron smelting industry is well established in Sweden, that five furnaces are in regular commercial use, and that at least three more are in course of erection. The Swedish iron industry consists, in the main, of smelting pure Swedish ores with charcoal in blast furnaces of very moderate dimensions and small yield. For this reason blast furnaces have been replaceable by electric furnaces, which in Sweden are commercially satisfactory. It is noted, however, that this is on account of the small size of the furnace used in Sweden, and on account of the high-grade quality of iron obtainable readily from the Swedish ore.

Electric Iron Smelting in Canada

The report goes on to discuss the possibilities of smelting iron by electricity in Canada. It is pointed out that the scale on which ore is turned out from the blast furnaces is here very much greater than in Sweden. The furnaces are larger, and the quality of iron is not so fine. These things considered, as well as certain other factors which add to the high cost of production, Dr. Stanfield is of the opinion that "at the present there is no evidence to show that electric iron smelting can be undertaken on a large scale in competition with the existing blast furnace industry." If, however, a purer quality of iron is required, the electric furnace appears to be the best, and almost only, method of producing it. The difficulty is with the sulphur contained in the iron ore.

Cold Weather Construction Methods

Used in erecting Hotel Traymore—Largest hotel resort in World constructed between December and April — Details Described

By D. L. Kneedler[1]

THE new Hotel Traymore recently completed at Atlantic City, N. J., is the largest fireproof resort hotel in the world. It has a floor area of over 470,000 sq. ft. and is 18 storeys high, the top of the domes being 238 feet above the sidewalk. The old building consisted of a 12-storey reinforced concrete tower faced with terra cotta at the board walk end of the lot and a low frame structure in the rear. The work included certain changes and additions to the existing tower, and the erection of an entire new building on the site of the old frame structure, both parts of the work being done at the same time. While the building is unusually large and complicated in detail, the more remarkable part of the work is the speed with which it was done, considering that it was carried on throughout the winter without stopping for freezing weather.

The site was cleared and ready for the builders September 1, 1914, and the hotel was opened for guests June 1, 1915.

Practically all of the reinforced concrete work was done between December 24, 1914, and April 24, 1915. This involved the mixing and placing of over 18,000 cubic yards of concrete, placing over 1,500 tons of reinforcing steel and over 1,200 tons of structural steel; also the making, erecting and removing of over 470,000 square feet of centering. The brick work and the partitions followed the concrete work as fast as the forms were removed, and the cinder concrete floor fill and concrete floor finish followed in turn.

The centering was particularly difficult as the floors were not typical, but with the exception of the third to the seventh sleeping floors, they changed at every floor, requiring the forms to be remade entirely. Over 1,500,000 ft. B. M. of lumber was used in making the forms. The curved forms for the domes and for the brackets under cantilevered balconies and other special work were made in a planing mill.

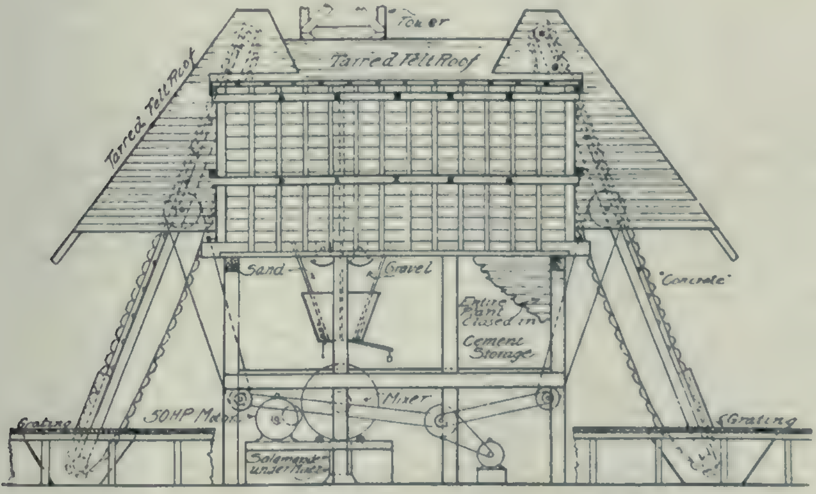


Fig. 1.— Diagram of Mixing Plant, showing provision for heating.

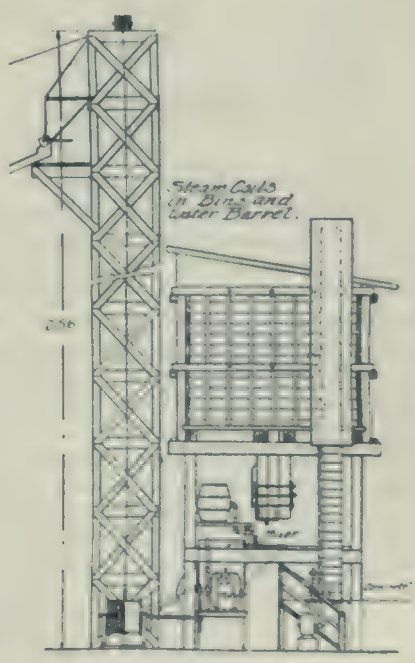


Fig. 2.--End section of Mixing Plant.

The building occupies the entire lot, and faces on one street only, which is not only narrow but is blocked at one end by the ocean and the board walk, so that there was little room to store materials at the site. A large storage yard was taken adjoining to the railroad where a cement shed was built, and where the reinforcing steel and structural steel were stored and sorted, to be taken to the site as required. The sand and gravel were stored in large bins at the yard and hauled to the site in motor trucks. Being in bins allowed this material to be loaded very quickly by means of gates.

General Construction

The foundations are of reinforced concrete resting on wood piles. The entire lot was first graded down to about four feet below the sidewalk or about high water line. The piles were then placed by means of a water jet, a follower being used to sink them to the proper elevation to receive the column footings, so that after all the piles were in place, the entire site appeared clear, none of the piles showing above grade. Each footing was sheathed separately and excavated to the piles.

The entire superstructure is of reinforced concrete and structural steel fireproofed with concrete. In order to accommodate the structure to the various architectural features, all kinds of concrete construction were used. In general the type of construction is solid slabs, with beams, girders and columns of concrete, but where large flat panels were required in the ceilings the combination of concrete joists and terra cotta tile fillers was used. Structural steel cores were used to keep down the size of heavily loaded columns and structural steel girders were used, where girders carried heavy concentrations, due to offsets in the column layout.

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[1] In Concrete and Cement Age.

All the floors are finished in concrete over a 2-inch cinder concrete fill, and after the reinforced work was well advanced, one plant was used for this work only.

Concrete Plant

There were two mixing plants at the building, the details of which are shown in Figs. 1 and 2. The motor trucks ran up an incline onto a plank platform and deposited the materials through iron grates in the floor into hoppers, from which they were raised by bucket conveyors to the bins over the mixer. Directly beneath the bins were the measuring hoppers loaded by means of gates as shown, and directly beneath the measuring hoppers was the mixer, 1 cu. yd. capacity, driven by a 50 h.p. electric motor which also operated the hoist.

The hoppers were quickly loaded by means of iron gates in the bottoms of the bins and as they were graduated the charge was accurately measured. In the bottom of the hopper was a gate held shut by a spring latch; by pulling a line the charge was deposited in the mixer. This gate was counterbalanced so that when the hopper was empty it closed itself. The cement was put in from the platform where the hoppers were filled; the water barrel was also on this platform. The barrel was accurately gauged to insure the proper quantity of water for each batch.

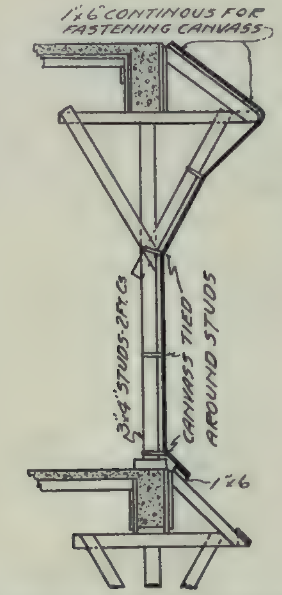
1"x6" CONTINOUS FOR FASTENING CANVASS
3"x4" STUDS-2FT. C.S.
CANVASS TIED AROUND STUDS
1"x6

Fig. 3.—Method used to hold canvas in place.

The towers for raising the concrete were 260 ft. high, 6 ft. x 8 ft. in plan, and had to be exceptionally well braced on account of the severe storms at the sea shore. From the towers the concrete was spouted into place where possible, but for some of the longer distances on the upper floors it was spouted as far as possible into a storage hopper and wheeled the rest of the way in buggies.

Heating and Protecting Concrete

As will be seen by a study of Figs. 1 and 2, the mixing plant was designed with special reference to the extreme weather conditions under which the work was carried out. The gravel from the storage yards was dumped on the platforms and at once carried to the covered bins by bucket elevators which were themselves housed as shown. The bins were lined with steam coils on all sides, insuring a steady supply of heated aggregate. A steam coil is also used in the water barrel. It will be noted, too, that a salamander is located under the mixer to prevent loss of heat while mixing. (Canvas was used to protect the concrete from the weather.)

Fig. 3 shows a detail of the method by which the canvas was securely held in place. Each storey was entirely enclosed as poured and salamanders were kept burning below each floor; the concrete as poured was at once covered with a heavy layer of salt hay, which remained till the concrete was thoroughly set. Work was carried on continuously day and night throughout the winter, but the precautions described were effectual and no frozen concrete resulted.

Will the U. S. Still Protest?

Latest figures to hand regarding United States foreign trade for the year ending October 31 would appear to discredit any claims that the commercial operations of that country are being interfered with. Indeed, they show that the European war has been a very decided incentive to an increase in that trade, as is shown in the following figures, indicating an increase in exports of well over a billion dollars:—

Imports	1915	$1,691,748.013
	1914	1,880,414.501
Exports	1915	3,318,634,636
	1914	2,140,847,829
Increase in Exports		...1,177,786,807

New Books

Water Power Engineering (2nd edition)—by Daniel W. Mead, A.S.C.E., Professor of Hydraulics and Sanitary Engineering in the University of Wisconsin; published by the McGraw-Hill Book Company, Inc., New York; price $5 net. In this edition the author has endeavoured to bring the text into accordance with the best modern (1915) practice relating to the theory, investigation, and development of water powers. Various changes, additions, and rearrangements of the first edition, published in 1908, have been made in order to treat the subject more fully and in a more logical manner. Almost every chapter has been revised and extended. Two systems of graphical turbine analysis, published in the first edition, are more simply and completely dealt with, and are believed to be of considerable value, one or other having been adopted by turbine manufacturers and engineers for presenting turbine data. No attempt has been made to treat in detail the subject of turbine design, as the work is intended, not for the turbine designer, but for the student and the engineer who may be called upon to select turbines for water power development. The book also deals with:—streams, their flow measurements and power; pondage and storage; dams, their construction and relation to power stations; the design, testing, relation, and selection of turbine machinery; and the financial and commercial considerations of water power projects. The book is well illustrated; 840 pages; size approximately 6 by 9 ins.

The Pelton Water Wheel Company have just issued a little booklet in Spanish, Portuguese, and English, which is intended to direct the attention of machinery users to the possibility of Pelton drive for every class of apparatus; also to more particularly direct the attention of people living in remote districts, where electrical energy is not available, to the possibility of using a small stream for the supply of light, heat, and power through the medium of the Pelton wheel.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

Why should Sir Robert Borden consult Sir Wilfrid Laurier as to the terms on which his government can prolong its lease of life? If that Government has been doing its duty no Opposition could bring on an election at a time like this without courting sure defeat. If it has not been doing its full duty then Sir Robert should make his explanations to the people and not to Sir Wilfrid Laurier.

* * *

Compound "profiteering" is the latest phase of money making at the expense of the Empire. The corporation that secures a contract that shows a hundred thousand dollars profit figures that it means dividends on another million dollars of stock. The stock is issued, unloaded on the confiding public and the $100,000 is turned into a million. With the proper connections and an elastic conscience much may be accomplished in those circles which figure that it is better to be a live millionaire than a dead hero.

* * *

Economy as a road to wealth has been preached to us from our youth upwards but it remained for Prof. Wrong of Toronto University to advise us to use the same material in building a road to victory. The learned professor advises us to buy only the necessaries of life, wear our old clothes and make the wife's spring bonnet do a reappearance for the fall. This is what a lot of our people did in the panic that followed the declaration of war. Rich men discharged their chauffeurs and drove their own cars. Wealthy women cut down their domestic help and forgot to patronize the milliner and dressmaker. If the rich didn't get richer the poor certainly got poorer and business was at a standstill. Fortunately we recovered before the whole country stagnated. The "business as usual" motto was printed on the wall and stamped on the door mat. As a result the Government has floated a war loan of $50,000,000 that was subscribed in a single day and business in nearly every line threatens to boom. Economy properly applied is a grand thing. It might not be a bad idea to economize by cutting the salaries of theorizing college professors, who talk learned nonsense.

* * *

That bulwark of Conservatism and sometime mouthpiece of the Borden Government, the Mail and Empire, gets staidly to its feet to remark:

"In Canada we know only too well that most makers of munitions and furnishers of other war supplies to the Canadian and British governments have striven to get large profits out of their contracts. Mr. David Thomas, Lloyd George's representative on munitions, who was in Canada recently, said that he had an offer from a Hamilton manufacturer to make a great quantity of shells at cost. This was most praiseworthy and in striking contrast to the attitude of the general run of 'profiteers.'"

Of course you cannot expect the Mail to go further and tell that the Hamilton manufacturer's offer was not even considered by the Shell Committee. Still an admission such as the above coming from a Conservative organ should convince Sir Robert Borden that the mystery surrounding the shell contracts is bringing protests from the stalwarts of his own party. If the Premier was not quibbling when he promised a searching enquiry into all war expenditures he will turn his official investigator, Sir Charles Davidson, loose on the Shell Game and the Purchasing Committee. The horse and horse feed scandals have been keeping him busy too long. It is time he was getting after the larger game.

* * *

Subscription lists to right of us, tag days to left of us—wherever we go. We are reminded that the present war is being carried on as a charitable institution rather than a National undertaking. Why should it be left to the charitably inclined to support the families of soldiers fighting the country's battles? Why should it be necessary to pass the hat for funds to aid recruiting? Why should it be left to the gererous to provide funds to be used in the interests of all? The government should accept its responsibilities rather than try to pass them on to the shoulders of others. The government has just as much right to provide the necessary money to secure recruits as it has to equip those recruits and pay them after they are equipped. The care of the families of those recruits is just as much a government responsibility as the payment of any other debt. He who cannot fight must pay his share. But on the Government should rest the responsibility of seeing that every man should pay in proportion to his ability and the stake he has in the country. This can only be done by the Government paying all bills and assessing the cost fairly on all concerned. The present haphazard system of doing things condemns the public-spirited citizen to pay not only his own share but also the share of the mean-spirited money-grabber who hoards every dollar till it is extracted by main force. There are wealthy men right around us who so far have not contributed a dollar for patriotic purposes. They never will contribute till the Government takes hold and tacks their share on to their tax bills.

* * *

The new Munitions Board has been announced by Mr. Hichens. It is eminently respectable from the chairman, Mr. J. W. Flavelle, to the member from far off Victoria. It is directly responsible to Lloyd George and as independent of the Canadian Government and Canadian politics as its members see fit to make it. Sir Sam Hughes has been placated for the practical obliteration of his Shell Committee by being made honorary chairman of the new body. It would be nice to know just what his powers and duties are. The two other military members of the Shell Committee, Brigadier General Bertram and Colonel Carnegie, have also been retained, the former as vice-chairman. The manufacturing members have been appointed to a committee on raw materials. Even they do not get a raw deal though their new positions are as "honorary" as their recently acquired colonelcies.

* * *

So we have the new Board and all we can do is to sit back and wait to see how it will act. In the meantime Sir Robert Borden must have heaved a great sigh of relief when Mr. Hichens pronounced those few kind words that served as the obituary of the Shell Committee. For each day brings forth fresh evidences of the peculiar brand of patriotism that characterized its every action. We now hear of a publisher who has been awarded a shell contract. That he did not have a plant when the contract was secured apparently mattered not. Neither was it of any consequence that he knew not the first rudiments of making shells. He has evidently since secured at least a site for his shell factory as last week he was in the United States buying machinery.

* * *

We are also told of a certain man who owned a woodworking plant and who naturally looked for, and obtained, a shell box order. When he applied for a further contract he was informed the committee were just out of shell box orders but they could give him something just as good. Wouldn't he take a shell contract? He was obliging and took it.

* * *

Now don't misunderstand me on this point. I am not finding fault with those who had the necessary plant and machinery and were fortunate to secure contracts. What I object to and what manufacturers object to is the peddling out of contracts to middlemen and go-betweens while legitimate manufacturers have their machine shops standing idle. I can supply Sir Robert Borden with a list of machine factories whose owners have vainly tried to secure shell contracts. I can show him where men are now offering to sell their factories to the fortunate men who have secured shell contracts.

* * *

Fifteen British journals have refused to accept Ford advertisements. They consider the Detroit car an alien enemy and refuse to do business with him. But up to the time of going to press not one Canadian paper has developed any symptoms of following suit. It is a notorious fact that our Canadian newspapers, with few exceptions, fail to recognize that they are under any obligation to their readers. They evidently figure that they give him a cent's worth of news for his copper. Beyond that "the public be ————." The feelings of the advertisers are considered generally, and the party to which they are proud to belong, always. In other words their advertising columns are at the service of mining stock speculators, oil company promoters and any other "bunk" operators who have money to spend. Similarly their editorial columns are filled with party eulogies and counter-charges against the opposing party that are calculated to deceive the public even as the fraudulent advertisers calculate to rob it. Is it any wonder that the public is taking the press even as its proprietors make it? A newspaper was once a public institution. It was a friend that called at the home each morning or evening to discuss the events of the day and offer friendly advice concerning them. That time is past. A newspaper is now a private business venture. It has but one object and that is to make money—or to serve some one party or individual. Of course, part of its money making equipment is a certain influence with the public. The latter, however, is considered less of a necessity each day and will soon be considered too old-fashioned for the modern journal. Of course, there are exceptions—but how many can you name?

* * *

That a temperance or rather a prohibition wave is sweeping over Canada no one will attempt to deny. It gathers force daily and it is only an indication of what is in the air that one political party has an outspoken prohibition policy while the other is feeling its way with an anti-liquor license board. And when you come to look for the cause you must conclude that the license holder has himself been the strongest prohibition argument. Of course there are exceptions but just about enough of them to prove the rule. Nobody believes that local option or any other temperance legislation will stop people drinking. The Porcupine mining district, which is prohibited territory, is notorious for its "blind pigs." Toronto the Good with its limited licenses is known to have scores of "speak-easys" within a short radius of the centre of the city, but the fact of the matter is that the great majority of the so-called hotel-keepers are in the business for revenue only. They want money and they want it quick. Their one aim is to get the last dollar out of the unfortunates who enter their doors. Poor accommodation and bad liquor are the rule. The man who has money can buy as long as he can stand up. The unfortunate who has spent his all is thrown out into the street to be picked up by the police. I am no prohibition advocate. I believe that what cannot be abolished should be controlled. But I must admit that the class of men now engaged in the liquor trade are not a credit to the community. If prohibition for a short time would rid the hotel trade of these people it might be a blessing in disguise. Neither are the manufacturers and wholesalers deserving of any sympathy: They have made no effort to improve the conditions that are responsible for the results that are bound to come.

* * *

The United States is not only gathering in all the munition orders in sight but is reaching out after the markets left open by Germany's exclusion from them. France too has decided that it will not always be war time and that after the Germans have been driven back across the Rhine the rebuilding of her industries will be the next great task. Even now she has a "machinery committee," in the United States composed of representatives of French agriculture, banking, commerce and industry. Each member is an expert in his line. They are observing, planning and inspecting. The buying will come after the war and it is estimated that their initial orders for machinery will amount to a billion dollars. Maurice Damour, Secretary of the Appropriations Committee of the Chamber of Deputies, who heads the committee, explains its objects as follows:

"We want to effect a general modernization in all French commercial, industrial, and agricultural lines. With our population reduced by war we will be compelled to equip our factories with modern machinery. The money that we spent in Germany for that purpose will be spent in the United States. The figure of $160,000,000 a year is small compared to what will be spent in the future, because the machinery of northern France has been destroyed, and as the Germans withdraw they will leave little that can be used by us. We shall eventually buy every kind of machinery, agricultural implements, tools, hardware, spinning machinery, and mining machinery. In return we want the United States to buy the manufactured output that the United States formerly bought from Germany, our toys, for instance."

"This is ample evidence that America's work in the near future is to rebuild Europe. By America I do not mean the United States but the North American continent, of which we, so humbly, form a part. What share is Canada going to take in the rebuilding? What steps are being taken to ensure her a reasonable part of the enormous business that is bound to come from that rebuilding? Is the French Machinery Committee going to visit us or is it to be allowed to sail for home under the impression that the Dominion produces good soldiers but mighty little else? Is our Minister of Trade and Commerce up and doing or simply up and orating? Is his department still busy producing blue books and trade reports or is it alive to the fact that trade for the future is of vastly more importance than reports of the past? Our business at present may be war. But if France, with the Huns within hailing distance of Paris, can still work out the future of her commerce surely Canada can spare Sir George Foster from the recruiting platform for long enough to get in touch with the French Committee and see if it cannot purchase some of its machinery from the people who are helping to drive the invader out of its country.

* * *

The resignation of the reverend editor of The Globe recalls the high hopes entertained by lovers of clean politics when, many years ago, it was announced that Dr. J. A. Macdonald would henceforth direct the destinies of one of Canada's most prominent dailies. With the prestige of the "cloth," backed by one of the most powerful religious organizations in the world, it was surely not too much to expect that Mr. Macdonald would now make himself heard in favor of clean government and in defence of his readers—the public. The "barnacles" continue to "stick," however, in comfort, and the public continue to be duped with the fox-farm and oil-stock advertisements—just like the other big dailies print. It was a splendid harvest that lay spread before him, and an efficient organization of harvesters was at his disposal. That he neglected to reap even a small portion will ever remain a keen disappointment to all honest electors.

"SEARCHLIGHT"

Letters to the Editor

The Editor, Windsor, Ont., Nov. 22, 1915
Contract Record:

In reference to articles recently appearing in your journal on "Planning Work Ahead to Insure Winter Activity," we submit the following on

Manufacturing Ahead During the Entire Winter

Your article in reference to planning work ahead to insure winter activity is not only a timely one but most interesting from our company's viewpoint also. Not only should it be work planned ahead but actual production done ahead.

As manufacturers of concrete block machines we find that those who contemplate the production of concrete stone as a rule wait with the purchase of their machinery until the spring of the year, and by taking this action they make a most serious mistake.

Building contractors having been practically idle during the winter are naturally anxious to get into the business traces in the early spring, and as quick as the frost is out of the ground and the sun's rays urge to activity they are ready to begin building operations. Those who wish to use concrete blocks, instead of being able to purchase blocks that have been made during the winter and are thus well cured, often purchase blocks from the makers who have also started operations in the spring, and, in consequence, blocks that have not been fully cured are purchased and used.

No greater mistake than this could be made, since a well-made block should at least have its proper curing period, and until blocks are only sold when they have undergone this proper curing period they will not become a standardized building unit.

Many concrete products plants are shut down in the fall and do not again begin operations until spring, and such are making even a greater mistake than those who first start a new plant in the spring. It is during the quiet building period that concrete stone should be made, and no matter how severe the weather the plants should be so arranged that work should never cease during the cold or winter period but instead it should be the concrete products plant's busiest period of manufacture, and all concrete products made during the winter period would be assured of undergoing their proper time period curing.

This is so strongly recognized in the United States that most of the larger plants have all arrangements made for winter work, and we have seen plants which went into the spring period with a quarter million 16-in. concrete stone ready for delivery. Most plants in the United States now cure by what is designated as low pressure steam curing, there being practically no pressure at all but simply the saturating of the curing chamber with a moist steam that may be best likened to a wet fog. The sooner our Canadian plants adopt this mode of curing and manufacture their products during the winter the sooner they will succeed in the standardization of this splendid building unit when it is well made and well cured.

We therefore claim that machinery and plant installation should occur in the fall and not in the spring.

We also claim that workmen are far better equipped by nature to work in winter, under proper housing conditions, than during the hot summer months, which are so enervating. Many a day's work is lost in the work of producing blocks in the summer that might better be devoted to outside work of whatever kind, including the laying up of blocks by the very workmen who were kept busy in making these concrete units during the winter. In this way workmen are also employed during the entire year, which also means better conditions for the workmen and their families.

Yours truly,
IDEAL CONCRETE MACHINERY CO., LTD.,
Per M. Wetzstein, President.

Personal

Mr. Henderson Mowat, who prior to City Engineer McArthur's appointment was acting engineer for the city of Guelph, Ont., has been appointed assistant engineer of the Ottawa division of the Grand Trunk Railway System. Mr. Mowat has had considerable experience in railway work.

Mr. F. F. Picard, formerly with the Indian Government service, but latterly with the Canadian Marine Department at Victoria, B.C, has been offered the position of engineer in charge of workshops with the British forces operating in Mesopotamia. Mr. Picard, who is a mechanical engineer of wide experience, offered his services to the Indian Government at the outbreak of the war.

Mr. George N. Watson, a member of the Engineer's Department of the city of St. Catharines, Ont., has left for Glasgow, Scotland, to join his old regiment, the famous Argyle and Sutherland Highlanders, and go with them to the front. Mr. Watson holds the long service medal, and has been a member of the National Reserves for some years. He acted as superintendent on the work of constructing the Ontario Street Viaduct and the St. Paul Street Bridge, St. Catharines.

Obituary

Mr. Charles Winegarden, head shipper for the Waterous Engine Works Company, of Brantford, Ont., died suddenly of heart failure on November 30th. He had been in the employ of the company for many years, and was highly esteemed. He was only 35 years of age.

Mr. George Goodwin, who a few years ago was one of the country's biggest contractors, is dead, at the age of 72. He was said at the time to have lost a fortune in the contract for the Victoria Memorial Museum in Ottawa. The cost of the building exceeded the estimates by a tremendous figure, but he carried out the contract. The late Mr. Goodwin was born in Dublin, Ireland, and came to Canada when a child. After leaving college he entered the contracting and building business with his uncle, the late James Goodwin. He was connected with the construction of railways, canals, locks, and public buildings of all kinds in various parts of Canada.

Mainly Constructional

East and West—From Coast to Coast

Hackett & Fosbre, contractors, Verdun, Que., have registered.

New brick and concrete streets in Ingersoll, Ont., will cost close upon fifty thousand dollars.

At South Harwich, Ont., fifteen hundred acres of marsh land have been reclaimed for the raising of crops.

The city of Chatham, Ont., building permits for the first ten months of the year exceed in value those for the corresponding period of last year.

Despite general slackness in the building trade, on Keewatin Avenue, North Toronto, there are dwelling houses now in the course of erection.

The Great Northern Company claim to have expended more than two and one-half millions in the purchase and reclamation of lands at False Creek, B. C.

The Hamilton Aero Manufacturing Company, Limited, is the name of a concern recently incorporated at Vancouver with a capital stock of fifty thousand dollars.

Frank Burgess has registered at Montreal under the style of the Burgess Manufacturing Company. The company will manufacture floor and wall covering.

Practically all the machinery for the new shell-making plant of the Canadian Malleable Iron Company, Limited, Owen Sound, Ont., has been received and is being installed.

Pumps and Power, Limited, is the name of a company recently incorporated with head office at Vancouver, B. C., and a capital stock of ten thousand dollars, to carry on a general engineering and contracting business.

The Steel Company of Canada, whose largest branch is situated in Hamilton, Ont., are making preparations to enlarge their plant in that city; the capacity of the plant will be increased by about seven thousand tons a year.

The city of Montreal expect to have to face a deficit of $2,363,000 next year, the estimated expenditure for 1916 being $14,363,000 and the estimated revenue $12,000,000. Reductions, temporary at least, are being made in the salaries of civic employees.

In all probability Stanstead, Que.. will be the scene of a considerable amount of building activity in the coming spring. It is expected that a number of fine residences, a new Roman Catholic church, a town hall, an hotel, and some business blocks, will be erected.

The new Government House at Toronto is practically ready for occupation. Many months have been devoted to the building and equipping of this important establishment, which will henceforth be the official residence and home of the King's representative in Ontario.

The Corbett Foundry & Machinery Company. Limited, Owen Sound, Ont., have installed a new core oven and a large crane, and new lathes and drills, and have increased their staff of moulders and machinists, to enable them to fill an order for shell-making machinery.

The Canadian Stamping Company, which is now being organized, has taken over the property in Ford City formerly occupied by the Steel Products Company, and is starting to manufacture cartridges. The company has orders at the present time for a million cartridges.

Many miles of sewers are being constructed in the west end of the city of Toronto. Four different contractors have machinery at work, and the total cost of the trunk and branch lines is about two million dollars. Several miles of asphalt pavement also are under construction.

Messrs. Routly & Summers, surveyors, engineers, and contractors, of Huntingdon, Que., and Haileybury, Ont, have obtained two very substantial road contracts in New York State. One is for 4.79 miles of waterbound macadam in the Akin-Johnstown district, and the other is for 5.34 miles in the Utica-Poland district.

During the past season Montreal laid over 40 miles of pavement, bringing up the total to 200 miles. The forty miles is the largest amount laid in any one season, and its size is due to exceptionally fine weather during the fall. In 1910 Montreal had only 70 miles of paved streets. This year a large proportion of asphalt has been used.

The Consolidated Mining & Smelting Company at Trail, B. C., is rushing to completion the new electrolytic zinc reduction plant whose output for a definite period has been ordered by the Shell Commission for use in the manufacture of munitions. Power will be obtained from the West Kootenay Light & Power Plant at Bonnington Falls.

The Brandon Shell Company, Limited, is the name of a new private company organized at Toronto to take over the business of the Brandon Shell Syndicate and to manufacture munitions of war. The capital stock of the company is one hundred thousand dollars, and the provisional directors include H. W. Shapley. W. B. Milliken, and G. McLaughlin, all of Toronto.

The Dominion Paint Works, Limited, Walkerville, Ont., announce that they have put their entire sales operation under the direction of Mr. E. L. Warner, who has so successfully operated their business for the eastern half of Canada. Mr. Warner, as sales manager, will locate his head office in the Lumsden Building, Toronto. Mr. John Grieve, who has been in charge of the Montreal office, is appointed eastern representative.

The site for a military barracks and an extensive drill ground in the municipality of South Vancouver has been offered to the Dominion Government, partly free of cost, by Reeve Gold. It is understood, also, that the owners of a local quarry have offered to supply free of cost all the building stone required, and that a Vancouver architect has volunteered to submit plans and specifications free and to supervise the erection of the building without charge.

The annual banquet of the Manitoba Good Roads Association was held in Winnipeg on the 23rd ult. Over two hundred and fifty prominent public men interested in the building up of good roads were present, and a number of speeches bearing on the work, and also breathing of patriotism. were made. Mr. S. R. Henderson, president of the Association, presided. A fervid patriotic address on the war situation was delivered by the Hon. Robert Rogers, Minister of Public Works. Mr. Rogers spoke of the necessity of being ready with the future development of the country after peace is declared, but urged his hearers not to lose sight of the fact that they must continue to organize new battalions for service at the front until the Kaiser's attempt to steal our liberties had been frustrated once and for all. He also said that the Government should take the lead in making preparations for the time when immigrants will again stream into the country. We could double our population in a few years' time after the war, he said, if we studied the situation and prepared now. Sir Douglas Cameron also spoke in a patriotic vein, dealing chiefly with the might of Britain's navy. The Hon. Thomas Johnson outlined the proposed policy of the Government in regard to the workings of good roads districts throughout the province, and promised the financial support of the Provincial Government to any good roads district to be organized in the future.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Alvinston, Ont.
The Town Council are considering repairs and extensions to a number of drains. Clerk, W. J. Weed.

Bedford, Que.
The waterworks system is being constructed by day labor. The engine for pumping and fire-fighting apparatus are not yet purchased. Secretary to the Town Council, A. T. Gould.

Blenheim, Ont.
The Pere Marquette Railway Company, Detroit, Mich., are having plans prepared for the construction of a water system. Work will include the laying of a 4-inch pipe to the lake. Superintendent, J. J. Corcoran, Detroit.

Brockville, Ont.
The Town Council have decided to install an electric sewage pump at the Fair Grounds Military Camp, and have left the matter in the hands of Engineer George Bryson.

The City Council have decided to lay watermains on Cedar, James, Charles and Pearl Streets by day labor. Engineer, G. H. Bryson.

Glace Bay, N. S.
The Town Engineer, A. McKinnon, is preparing plans for the installation of a pumping unit, estimated to cost between $5,000 and $10,000. He is desirous of receiving prices and other information from prospective tenderers.

Leamington, Ont.
The laying of a concrete pavement on Mill and Russell Streets is being considered by the Town Council. Clerk, R. M. Selkirk.

New Toronto, Ont.
The Village Council are considering the establishment of a meter system in connection with the newly completed waterworks system. Superintendent, Hugh Thomas.

Sarnia, Ont.
The City Council will submit a by-law at the January elections to provide for the construction of extensions to the watermains. Approximate cost, $12,000. Clerk, James D. Stewart.

Toronto. Ont.
Commissioner of Works R. C. Harris has recommended the following work:—asphalt pavements, $95,700; asphaltic concrete pavements, $25,000; brick block pavements, $21,100; rocmac macadam pavements, $6,700; sidewalks and curbings. $8,700.

The Board of Control will receive tenders until December 21st for the construction of sewers on Cawthra Avenue, Indian Road, Keele Street and Woodville Avenue. Plans at office of the Works Department, City Hall.

CONTRACTS AWARDED

Port Moody, B. C.
The general contract for the construction of a waterworks system for the Municipal Council has been let to the Robertson-Godson Company Ltd., 572 Beatty Street, Vancouver, at $37,050.

Railroads, Bridges and Wharves

Armour Township, Ont.
The Grand Trunk Railway Company, Montreal, have been authorized to construct a siding into the premises of the Magdnetawan Tanning & Electric Company, Ltd., District of Parry Sound.

Blenheim, Ont.
The Pere Marquette Company. Detroit, Mich., contemplate the double-tracking of the line between Blenheim and Wilkie. Plans will be prepared. Superintendent, J. J. Corcoran, Detroit

Dunnville, Ont.
The Toronto, Hamilton & Buffalo Railway Company, Hamilton, are considering the construction of a railway between Dunnville and Port Maitland. Engineer, H. L. Latham.

London, Ont.
The work required in the placing of a cement coping and handrail on the West London breakwater will be done by day labor. Engineer, H. A. Brazier.

Moncton, N.B.
The contract for roofing in connection with the Aberdeen School now in course of erection has been let to the Standard Paint Company, 52 Victoria Square, Montreal.

Ottawa, Ont.
J. R. Booth is building a bridge on Booth Street, and is purchasing girders and other material himself. Steel construction, timber flooring.
ad pub buildings awarded ... .

Peace River Crossing, Alta.
The Edmonton, Dunvegan & British Columbia Railway Company, Edmonton. have commenced the erection of a trestle bridge over the North Heart River.

Quebec, Que.
In connection with the theatre which is being built on Fabrique Street for the Quebec Theatre Company, the carpentry contract has been let to E. Paquet & Company, 16 Couillard Street.

Ste. Martine, Que.
Tenders will be received until 10 a.m., December 15th, by N. Mallette. Secretary to the Municipal Council, for the construction of two concrete abutments. Plans and specifications at office of the Secretary.

Toronto, Ont.
The Board of Control have decided to submit to the ratepayers on January 1st a by-law to guarantee debentures to the amount of $3,000,000 as the city's part of the Provincial Hydro Electric Radial scheme.

CONTRACTS AWARDED

Hammond, Que.
The general contract for the erection of a bridge for the Municipal Council has been awarded to A. Beauchesne, Arthabaska, and the contract for steel work and flooring to MacKinnon, Holmes & Company, Ltd., Drummond Road. Sherbrooke. Approximate cost, $4,000.

Public Buildings, Churches and Schools

Elmvale, Ont.
Tenders will be received until 1 p.m., December 20th, by W. J. McGuire, Elmvale, Ont., for the erection of an addition to the school for the Trustees of School Section No. 5, Flos. Plans and specifications at offices of the Architect, John Wilson, Collingwood, the Secretary, and of the Contract Record, 25 Charlotte Street, Toronto. Brick construction, concrete foundation, stone trim, shingle, felt and gravel roofing.

Farnham, Que.
Tenders will be received until noon, December 10th, by G. L. Elmes, Secretary to the Protestant High School Board, for the erection of a school. Plans and specifications with the Secretary.

Glace Bay, N. S.
The School Board are considering the erection of an addition to the High School at an approximate cost of $5,000. Work will start next year. Chairman, W. E. Spencer.

Grey County, Ont.
The County Council have decided to call for new tenders on the erection of an addition to the Registry Office Building. Clerk, F. H. Rutherford, 863 Second Avenue, Owen Sound.

Hamilton, Ont.
The Hospital Superintendent, Dr. Langrill, is receiving tenders on hospital supplies, including bedsteads, lockers, windsor chairs, operating table, kitchen utensils and chinaware.

Sorel, Que.
The proposed building at George and Prince Streets for the Convent de la Congregation will not be erected.

St. Catharines, Ont.
The Congregation of Haynes Avenue Presbyterian Church are considering the erection of a hall. Brick construction, stone foundation. Estimated cost, $5,000.

Thorold, Ont.
Tenders are being received by C. E. Millar, Secretary to the Public School Board, on the supply of seats, desks, etc.

CONTRACTS AWARDED

Bathurst, N. B.
The contract for alterations and additions to the Post Office fittings has been let by the Department of Public Works,

Alexandria, Ont. Ottawa, to the J. T. Schell Company,

Lachine, Que.
The contract for roofing in connection with Fire and Police Station No. 2, now in course of erection for the City Council, has been let to J. A. Dubois, 444 St. Joseph Street, and the electrical work to E. I. Miller Bros., 24 Notre Dame Street.

Little Current, Ont.
The Town Council have let the contract for heating and ventilating in connection with the school which is to be erected to The Farrell Engineering Company, Cassells Street, North Bay, at $3,015.

Maisonneuve, Que.
The following contracts have been awarded in connection with the Church of St. Jean Baptiste de La Salle, now being built:—supply of stone, Damase Naud, St. Marc des Carrieres, Que.; roofing, M. Chouinard, 751 Adam Street; mill work, Z. Corbeil & Frere, 3 Desjardins Avenue; electrical work, J. A. Gagnon, 7333 Notre Dame Street.

Montreal, Que.
The contract for plastering in connection with the church and presbytery which are being erected on Parthenais Street for the Russian Congregation of St. Casimir has been awarded to H. Pepin, 218 Gauthier Street, and the electrical work to J. Brien, 1119 Mount Royal Avenue E.

New Westminster, B. C.
The contract for the installation of a freight elevator at the Public Building for the Department of Public Works, Ottawa, has been let to Sloane & Harrison, Western Trust Building.

Ottawa, Ont.
In connection with the monastery in course of erection for the Community of the Precious Blood, Echo Drive, the contract for floors, partitions and furring has been awarded to the Montreal Terra Cotta Company, Ltd., 42 St. Sacrament Street, Montreal. Painting by day labor.

Vancouver, B. C.
The Department of Public Works, Ottawa, have let the contract for the installation of fittings at Postal Station C, Fifteenth Avenue and Main Street, to the Berlin Office & Fixture Company, Ltd., 34 Lancaster Street W., Berlin.

Business Buildings and Industrial Plants

Aylmer, Que.
The alterations to the club house of the Ottawa Golf Club on the Aylmer Road are being carried out by day labor under supervision of A. J. Tomlinson, 92 Florence Street, Ottawa.

Hamilton, Ont.
Work has been started by the Proctor Gamble Company, Burlington Street E., on the erection of an addition to their factory. A contract may be let for roofing. Approximate cost, $7,000.

The Dominion Steel Castings Company, Depew Street, have commenced alterations to their premises, estimated to cost $10,000.

Haileybury, Ont.
The Riordon Pulp & Paper Company, Ltd., 1 Beaver Hall Square, Montreal, are making alterations at the Foster Saw Mill on the Lake Shore Road, which they have purchased. Work includes the erection of a wooden trestle 500 feet long.

Montreal, Que.
The City Council have commenced the erection of a comfort station in Lafontaine Park. Work is being done by day labor. Estimated cost, $7,000.

Scroggie, Ltd., St. Catherines and Amherst Streets, are considering alterations to their premises.

Plans are being prepared for a foundry to be erected for the Williams Manufacturing Company, Ltd., 1789 St. James Street. Steel and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $15,000. Architect, J. C. McDougall, A. R. I. B. A., 511 St. Catharine Street.

Ottawa, Ont.
Work has been started by C. C. Colman, 101 James Street, on the erection of a garage. Brick veneer construction, concrete foundation, felt and gravel roofing.

Parry Sound, Ont.
Work is progressing on the erection of an addition to the Odeon Theatre. Seating and a quantity of metal wall and ceiling covering will be required. Manager, George Parker.

Peace River Crossing, Alta.
Berhold Hopp is building a theatre on Main Street. Frame construction, shingle roofing.

Sault Au Recollet, Que.
J. R. Walker, 35 Common Street, Montreal, are repairing their cardboard mill, but will not rebuild their paper mill until the spring.

Ste. Anne De Bellevue, Que.
Work is about to start on repairs to the Hotel Clarendon for P. Rousseau. Carpentry, plastering and painting will be done by day labor. No contracts will be let.

Thorold, Ont.
The Torold Agricultural Society are considering the erection of additions to their buildings, and will probably call for tenders in the spring. Secretary, John W. Shriner.

Toronto, Ont.
G. H. Lawrence, 49½ Helena Avenue, is building a hall at Arlington and Benson Streets, at an approximate cost of $3,000. Painting by day labor.

The erection of a number of stables and an implement building at the Exhibition is being considered by the Board of Control and the Exhibition Board. Approximate cost, $3,500.

The Canadian Northern Railway Company, 34 Victoria Street, have commenced the erection of a shed and platform at Front Street and Eastern Avenue. Frame and galvanized iron construction. Estimated cost, $4,000.

Westport, Ont.
R. J. Whaley will rebuild his store and residence in the spring, and will purchase lumber and material for roofing and steam heating. Brick construction. Estimated cost, $4,000.

CONTRACTS AWARDED

Brantford, Ont.
In connection with the street railway station and convenience which are being built on Market Square for the City Council, the contract for heating and plumbing has been let to R. H. Ballantyne, 5 King Street.

Burnaby, B. C.
Work has been started on clearing the site of the oil plant for the Shell Oil Company, Fifth and Carolina Streets, Vancouver. The contract for the erection of buildings has been let to W. J. Prout, 1412 Burard Street, Vancouver.

Cobourg, Ont.
The contract for the supply of roofing material for the garage in course of erection on King Street S. for Sparling & Reeson has been awarded to the Canadian H. W. Johns-Manville Company, Ltd.

Georgetown, Ont.
The Glass Garden Builders, Limited, 201 Church Street, Toronto, are about to start work on the erection of a factory, estimated to cost $25,000. The contract for steel work has been awarded to McGregor & McIntyre, 1139 Shaw Street, Toronto. Owners will do heating and glazing and will superintend construction. Brick construction, saw tooth roof.

Hamilton, Ont.
The following contracts have been let in connection with the alterations which are being carried out at the Y. M. C. A. Building, James Street:—masonry, G. Webb, Wentworth Street; carpentry, steel and roofing, J. Vogan, 280 Sanford Avenue W.; plastering, Hill Bros., 307 Emerald Street N.; painting, Smith & Omand, 177 Walnut Street S.; heating and plumbing, J. Allen, Emerald and Barton Streets; electrical work, Lowe & Farrell, James Street S.

In connection with the office building which is being erected on Main Street E. for the Mercantile Trust Company, Bank of Hamilton Building, the painting contract has been let to Goodale & Laidlaw, 20 Hunter Street E., and the heating and plumbing to Adam Clark, Main Street W.

The contract for plastering in connection with the warehouse which is being built on Hughson Street for the Lister Estate, has been let to J. Hill, 303 Emerald Street W., the painting to J. Scott, 439 Charlton Avenue W., and the electrical work to Snyder Bros., 37 King William Street.

In connection with the erection of an addition to a factory on Sherman Avenue, N. for the Steel Company of Canada, Harvey Lane, the contract for steel work has been let to the Hamilton Bridge Works Company, Ltd., Bay Street North.

Lindsay, Ont.
The contract for additions to the premises of T. Bakogeorge, Kent Street, has been let to M. McGeough.

Montreal, Que.
The following contracts have been let in connection with the store and residence in course of erection for Mrs. E. Lecavalier, 65 Cherrier Street:—brickwork, T. Frenette, 615 Garnier Street; roofing, Lavigeur & Menard, 2483 St. Lawrence Boulevard; electric wiring and fixtures, H. Truchon, 210 Plessis Street; glazing, Ceramo Vitrail Company, 2054 St. Lawrence Boulevard. Painting by day labor.

Work has been started by Arsenault & Plamondon, 70 St. James Street, on the erection of an addition to the Pump House, Papineau Avenue, for the City Council. The pump to be installed will have a capacity of 6,000,000 gallons per day.

The contract for the installation of an elevator at the office and warehouse building which is being erected for the Patterson Manufacturing Company, Ltd., 2021 St. Hubert Street, has been let to the Otis-Fensom Elevator Company, Ltd., 368 St. James Street.

Work has been started by A. Hillis on the erection of a workshop for S. Ryan, 4123 St. Catherine Street W. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Port Arthur, Ont.
The contract for the installation of fittings at the examining warehouse has been let by the Department of Public Works to W. J. Trick & Company, Ltd., Albert Street, Oshawa.

Sherbrooke, Que.
In connection with the gas plant building in course of erection for the City Council, the contract for steel work has been awarded to the Dominion Bridge Company, Ltd., Lachine. No other subcontracts will be let.

St. Hyacinthe, Que.
The contract for painting in connection with the theatre which is being built by N. D. Bouchard has been awarded to Beaunoyer & Lalime, 95 Cascades Street, the heating and plumbing to H. Lorange, 254 Cascades Street, and the electrical work to I. E. Provost, 209 Cascades Street.

St. Thomas, Ont.
The contract for plastering at the office building which has been erected for the Huron & Erie Loan Company, 336 Talbot Street, has been let to Charles H. Lea, 257 Ross Street, and the heating and plumbing to W. J. Milton, 658 Talbot Street. General contractor, G. E. Ponsford, 66 Centre Street.

Toronto, Ont.
Work has been started on the erection of a store at Bloor and Sherbourne Streets for S. B. Hinder, 109 Heath Street. The contract for masonry has been let to John W. Gratton, 486 Clinton Street. Artificial stone and tapestry brick construction. Estimated cost, $5,500.

In connection with the warehouse which is being built at College Street and Palmerston Avenue for the Crompton Corset Company, 78 York Street, the contract for heating has been awarded to Purdy, Mansell Ltd., 65 Albert Street, and the contract for installation of elevators to the Turnbull Elevator Company, John Street.

Work has been started on the erection of a garage at 482 Avenue Road for H. Heintzman, 195 Yonge Street. The contract for masonry and concrete work has been let to J. A. Wickett Ltd., Traders Bank Building, and the carpentry to T. J. Sproule, 54 Shanley Avenue. Brick construction, shingle roofing. Estimated cost, $4,000.

Work is progressing on the erection of the dairy building of R. W. Dockery, 21 Essex Street. The general contractor is J. W. Gratton, 486 Clinton Street. Roofing will be sub-let by the contractor. Approximate cost, $3,500.

Windsor, Ont.
The general contract for alterations to the Dougall Block on Sandwich Street for Simon Meretsky, Mercier Street, has been let to Sculland & Humphries, La Belle Building, the heating contract to the Windsor Hardware Company, 71 Sandwich Street E., and the plumbing to Pennington & Brian, 47 Sandwich Street W.

Residences

Lachine, Que.
Arthur Fournier, 89 Third Avenue, has commenced the erection of a residence, estimated to cost $5,000. Brick construction, concrete foundation, felt and gravel roofing.

Maisonneuve, Que.
C. Lalonge, 601 Girard Street, is building a residence, estimated to cost $5,000. Brick construction, stone front, felt and gravel roofing.

Work has been started by H. J. Harrison, 100 Bennett Street, on the erection of four flats, estimated to cost $6,000. Brick construction, felt and gravel roofing.

A. Senecal, 731 Desjardins Street, has commenced the erection of a residence. Brick construction, felt and gravel roofing. Approximate cost, $4,000.

Montreal, Que.
Thomas Jones, 76 St. Jean Baptiste Street, Outremont, has commenced the erection of four flats on St. Adele Street, estimated to cost $4,000. Brick construction, concrete foundation, felt and gravel roofing.

Work has been started by George Rattelade, 47 Marquette Street, of the erection of six flats on Christophe Colomb Street. Brick construction, felt and gravel roofing. Approximate cost, $7,000.

Ottawa, Ont.
A. W. Davidson, 69 Grosvenor Street, is considering the erection of a residence to cost about $4,000. Stucco and brick veneer construction, concrete foundation, shingle roofing.

G. E. McMenemy, 40 Roslyn Avenue, is about to erect a residence on Grove Street, estimated to cost $6,000. Brick veneer construction, concrete foundation, shingle roofing. Owner will do foundations and carpentry and will let the remainder of work.

T. J. Somerville, 28 Waverley Street, is considering the erection of a residence on Fifth Avenue, at an approximate cost of $4,000. Brick veneer construction, stone foundation, shingle roofing.

Outremont, Que.
Pierre Guidazio, 615 Bloomfield Avenue, has started work on the erection of a residence on Rockland Avenue. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $8,000.

Port Burwell, Ont.
Percy Ryerse is considering alterations and repairs to his bungalow, which was recently damaged by fire.

Quebec, Que.
J. E. Giroux, 51 Cote d'Abraham St., is receiving prices on all materials required in connection with the residence which he is building on St. Augustin St.

J. Careau, 32 Maisonneuve Street, has commenced the erection of a residence, estimated to cost $3,000.

Sandwich, Ont.
Tenders will be received until December 10th for the conversion of a hotel into four flats for A. [illegible], Sandwich Street W., Windsor. Architect, J. C. Pennington, La Belle Building, Windsor. Frame construction, concrete foundation. Estimated cost, $4,000.

Toronto, Ont.
Miller & Ingram, 23 Perth Avenue, have commenced the erection of a residence at 28 Glenholme Avenue, estimated to cost $3,000. Brick construction, shingle roofing.

Work has been started by A. E. Crowne, 48 Rhodes Avenue, on the erection of a pair of residences estimated to cost $3,100. Brick construction, shingle roofing.

S. B. Green, 650 Annette Street, is receiving tenders on drain and concrete work required at the residence which he is building at 28 Hutchinson Avenue.

Uxbridge, Ont.
John Quantz, Whitvale, Ont., will rebuild his residence on the Fifth Concession in the spring. Material will be purchased by owner.

Windsor, Ont.
Tenders will be received by J. C. Pennington, Architect, La Belle Building, between December 15th and 31st, for the erection of a residence on Victoria St. Stucco construction, stone trimming, concrete foundation, slate and shingle roofing. Approximate cost, $5,000.

Plans have been prepared for three cottages to be built on Dougal Street for A. Silby, Church and Elliott Streets. Architects, Leybourne & Sewell, Sandwich Street E. Brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $2,900 each.

CONTRACTS AWARDED

Halifax, N.S.
In connection with the residence which is being built on Young Avenue for C. O. MacDonald, Chester, N. S., the contract for carpentry, roofing, plastering and painting has been let to G. B. Lowe, Oakland Street, and the heating, plumbing and electrical work to Farquhar Bros., Ltd., Barrington Street.

Hamilton, Ont.
J. H. Somerville, 166 Prospect Street, has let the following contracts in connection with the erection of a residence on Leinster Avenue:—masonry, Lemington & White; plastering, F. Mountain, Barton Street E.; heating and plumbing, H. Barnes, 23 Fife Street; electrical work, F. Thornton, 174 Balmoral Avenue. Owner will do carpentry and roofing. Estimated cost, $3,500.

In connection with the residence which is being built by Sparks & McKay, 9 Fairholt Avenue S., the contract for painting has been let to F. Hall, 1236 Barton Street E., and the electrical work to H. John Fish, 291 Crockett Street.

The following contracts have been let in connection with the residence which is being built on St. Clair Avenue by McKay Bros., Lister Building:—plastering, John Hancox, 141 William Street; painting, F. A. Thompson, 36 Edward Street; electrical work, J. Dynes, 161 Sandford Avenue. Heating and plumbing not yet awarded.

Huntingdon, Que.

George Cowan has let the following contracts for the erection of a residence on Wellington Street:—general contract and carpentry, George Clark; masonry, D. McNair; roofing, A. B. McDonald; plastering, A. Thompson; painting, S. Garin; heating, J. A. Hunter; plumbing, William Hunter; electrical work, E. Burrows. Frame construction, concrete foundation, metal shingle roofing. Estimated cost, $4,500.

P. A. O'Connor, Chateauguay Street, has let the following contracts for the erection of a residence on King Street: —masonry, D. McNair, Wellington St.; carpentry, George Nesbitt; roofing, J. A. Hunter, Chateauguay Street; plastering, David Cunningham; heating, E. Henry, Chateauguay Street; plumbing, A. N. McDonald, Chateauguay Street; electrical work, E. Burrows; interior fittings, J. Hunter & Sons, Henderson Street. Estimated cost, $4,000.

Work has been started on the erection of a residence on Lake Street for Alexander Thompson. The general contract has been let to G. Cowan, the masonry to D. McNair, and the roofing to A. N. McDonald, all of Huntingdon. Plastering by owner. Other contracts not yet awarded. Estimated cost, $5,000.

Maisonneuve, Que.

In connection with the residence which has been built on Desjardins Street for J. A. Gagnier, 325 LaSalle Avenue, the contract for roofing, heating and plumbing has been let to W. Theriault, 283 William David Street, and the carpentry and interior fittings to the general contractor, J. Durand, 944 Desjardins Street.

Arthur Corbeil, 100 Bourbonniere Street, has commenced the erection of five flats for Corbeil & Frere, Desjardins Street. Brick and stone construction, felt and gravel roofing. Approximate cost, $8,000.

Montreal, Que.

In connection with the residences which are being built on Harvard Street by N. Peloquin, 335 Harvard Street, the contract for plastering has been let to J. O. Nantel, 86 Old Orchard Avenue, the roofing, plumbing and heating to E. Mongrain, 21 Monk Boulevard, and the electrical work to J. Simard, 1365 Wellington Street. Masonry and carpentry by owner.

Ottawa, Ont.

The general contract for the erection of a residence on Hinton Avenue for R. A. Smith has been let to I. Villeneuve, 164 Bayswater Avenue. Brick veneer construction, concrete foundation, shingle roofing. Estimated cost, $3,500.

In connection with the double residence which is being built on Melrose Street for J. W. Foster, 11 Irving Street, the contract for plumbing and heating has been let to H. Clements, 197 Holland Avenue, and the electrical work to C. C. Gould, Woodroffe, Ont.

The contract for electrical work at the residence which is being built on Cameron Street by F. Fentiman, Ottawa South Planing Mill, has been awarded to the Dominion Electric Construction Company, Sparks Street.

The general contract for the erection of a residence on Roslyn Avenue for C. G. Jones and M. Webster, 615 Cooper Street, has been let to Walter Fryer, 5 Glen Avenue. Stucco and brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $4,000.

The general contract for alterations to apartments on Clarence Street for James Cavanagh has been awarded to H. Dagenais, 223 St. Patrick Street. Brick veneer construction, felt and gravel roofing. Estimated cost, $4,000.

F. Fentiman, Ottawa South Planing Mill, has let the contract for heating and plumbing in connection with the erection of a residence on Cameron Street to Girvin & Lillico, 1095 Bank St.

The plastering contract in connection with the residence in course of erection on Fairbairn Street for W. J. Spratt, 157 Sunnyside Avenue, has been awarded to James A. Bowman, 239 Florence St., and the heating to the Pease Foundry Company, 287 Lyon Street.

W. H. Lee, Billings Bridge, has let the contract for electrical work at the residence which he is building to the Dominion Electric Company, 344 Sparks Street.

Outremont, Que.

The contract for electrical work at the cottage which has been built by H. Candlish, Apartment 1, 1080 Van Horne Avenue, has been let to C. Egan, 3326 Verville Street.

Port Credit, Ont.

Work is progressing on the erection of a residence for M. Langmuir. The carpentry work has been let to J. S. Ross, 31 Prospect Street, Toronto. Brick, frame and stucco construction, shingle roofing. Estimated cost, $5,000. Architect, H. F. Secord, 17 Queen Street E., Toronto.

Quebec, Que.

In connection with the residence in course of erection for H. Pare, 18 d'Youville Street, the contract for roofing, heating, plumbing and electrical work has been awarded to Jobin & Paquet, Cote d'Abraham Street, and the painting to Marier & Tremblay, Du Pont Street.

A. Fackney, 107 St. Joachim Street, has let the contract for roofing in connection with the residence in course of erection on Abraham Street to O. Barbeau, 154 Franklin Street, the painting to B. Leonard, 53 St. John Street, and heating, plumbing and electrical work to John Walker, 122 St. John Street.

Work has been started on the erection of a residence on St. Gabriel Street for L. R. Demers, 407 St. John Street. The general, masonry and carpentry contracts have been awarded to C. Jobin, 198 Lockwell Street. Approximate cost, $7,000.

St. Catharines, Ont.

Wilfred Harrop, Vollett Street, has commenced the erection of three residences for the St. Catharines Improvement Company, St. Paul Street. Stone, frame and stucco construction. Estimated cost, $3,500 each.

Toronto, Ont.

In connection with the residence which has been built at 24 Summerhill Gardens for A. E. Osler, 7 Melinda Street, the painting contract has been let to Cornelius & Company, 50 Walker Ave.

The contract for plastering in connection with the residence in course of erection on Astley Avenue for Craig & Madill, Architects, Manning Chambers, has been let to Wallace Hainey, 197 Degrassi Street.

The general contract for the erection of a residence for Mrs. F. Spragge, 17 Willcocks Street, has been awarded to T. Painter & Son, 333 Huron Street. Brick construction. Estimated cost, $3,000.

Westmount, Que.

The general contract for the erection of a residence and two garages for O. H. & N. A. Timmins, 4 Park Crescent, has been let to E. Garrigan, 218 Ballantyne Avenue, Montreal. Brick construction, felt and gravel roofing. Approximate cost, $8,000.

Windsor, Ont.

William Hedrick, 6 Glengarry Avenue, has commenced the erection of a residence on Ontario Street for William Hancock, 79 Albert Street. Brick veneer construction, concrete foundation, shingle roofing. Approximate cost, $3,500.

Power Plants, Electricity and Telephones

Biddulph Township, Ont.

A by-law has been passed providing for the installation of a hydro electric system at an approximate cost of $3,500. Work is expected to start this month. Clerk, W. D. Stanley, Granton, Ont.

Brooke Township, Ont.

The Brooke Municipal Telephone Company propose to extend their system into Warwick Township, and will require supplies and equipment. Secretary, John Warner, Alvinston, Ont.

Burgessville, Ont.

A by-law to provide for the construction of a hydro electric system at an approximate cost of $3,500 will shortly be submitted by the Township Council of South Norwich. Clerk, A. McFarlane, Otterville, Ont.

Hull, Que.

The City Council are considering extensions to the lighting system, estimated to cost $20,000. Clerk, H. Boulay.

St. Thomas, Ont.

The Hydro Board at London have been instructed by the Michigan Central Railway Company, Detroit, Mich., to electrify their terminus at St. Thomas. Estimated cost, $8,000.

West Lorne, Ont.

The Town Council will submit a by-law on December 20th to provide for the installation of a hydro electric system. Clerk, J. S. Robertson.

Miscellaneous

Georgetown, Ont.

C. B. Dayfoot & Company are in the market for one 20 to 25 h.p. boiler to carry 40 pounds, and for one 35 to 40 h.p. boiler to carry 75 pounds.

London, Ont.

The London & Port Stanley Railway Board are considering the purchase of a number of passenger cars. Secretary, W. Spittal.

Moncton, N.B.

E. Brooks, plumber, is in the market for the following materials, and desires prices, etc.:—plumbing fixtures, electric lighting fixtures, gas cookers and gas fires.

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The Accumulation of Construction Work and its after-the-war Effects

ONE often hears the theory advanced that "after the war" a great business depression will be felt all over Canada, and our labour troubles will just begin. The reason given is that our present business prosperity is transitory and specialized, and, as a matter of course, this phase of our commercial life will die a natural death when the demand for war supplies ceases.

This attitude of mind entirely overlooks the altered conditions under which Canadians are operating as compared with, say, three years ago. All over Canada private individuals and companies, cities, towns, and smaller municipalities (unless engaged in some way with war contracts) are simply marking time as far as extension work is concerned. The same is true to a very considerable extent of the Provincial and Dominion Governments. None of these, be it noted, have abandoned their plans for buildings and extensions. They are simply waiting till the workmen at present occupied otherwise shall be set at liberty, and until it has been shown that the money necessary for the war has been supplied. Granting, then, the argument that the moment the war is over there will be such a supply of money and workmen as this Dominion as never seen, this is a condition to welcome rather than fear—simply on account of the accumulation of construction work already mentioned. One may get a fair idea of the amount of this accumulation by comparing the sum-total of building and construction work during the year 1915 with the year 1912 or 1913, for example. Or take the outlook in the city of Toronto alone, and the immediately surrounding districts. At the present time there is under consideration a radial railway scheme by the Hydro-Electric Power Commission of Ontario covering an expenditure of some fourteen million dollars. A special committee appointed by the City Council has just made a report on a semi-rapid transit scheme to cost about nineteen million dollars. Construction on a huge Union Station is just getting under way. Harbour improvements calculated to cover many years' operations are progressing. To say nothing of many buildings that are planned but temporarily held up for lack of money and workmen—for we are actually approaching that condition when workmen are difficult to procure.

Our Bank Deposits Increasing

The following figures indicate the total sums on deposit, for the last three years, in the bank of Montreal at the close of their fiscal year. These figures are taken from the annual report of this bank just made public:

1913	$189,572,838
1914	197,222,674
1915	236,022,812
Gain over 1914	38,800,000
Gain over 1913..	46,450,000

The man who views the immediate future of Canada with anything but confidence is surely a chronic pessimist. He forgets that an ample supply of money and men, and an accumulated demand for both, means real development and permanent prosperity. That, plainly, will be our position just as soon as we have finished this other business, for which, at the moment, every other work must wait.

But, while it waits, it accumulates.

What Is Competition?

Competition, it has been said, is when a pair of chronic dyspeptics get down to comparing symptoms.

Extension to C. P. R. Hotel, Lake Louise, Alta.

Reinforced Concrete Construction — Work Carried on Chiefly in Winter Months — Isolated Electric Plant

By William Wren Hay, B.Sc. (Jr. Can. Soc. C. E.)

THE Canadian Pacific Railway have recently completed extensions to their hotel arrangements at Lake Louise, in the Rocky Mountains, 5,700 feet above sea level, consisting of three isolated units of 30 rooms each, a concrete fireproof wing of 122 rooms, besides a laundry and steam plant, sewage disposal tanks, enlargement of water power plant, and numerous smaller alterations. The hotel buildings are grouped at the outlet of Lake Louise, and apart from their scenic interest, they form an interesting architectural group and an excellent example of the planning and equipment of an isolated community. The present facilities are the outcome of the steady increase in the tourist travel developed along the main line of the C. P. R., through the Canadian Rockies, and provide accommodations for about 500 guests at one time, including laundry, steam heat, electric lighting, livery stables, and a narrow gauge railway from the railroad station, 3 miles away and 600 feet lower, in the valley of the Bow River. The first Chalet was erected in the early nineties, and was a simple log cabin, used only for private parties, guests of the railway. From time to time additional facilities have been provided, but it was not until 1910 that a definite group was planned, and in the summer of 1911, construction was commenced on the new buildings, and additions and alterations to existing buildings, to provide ultimate accommodations for 500 guests, so that, together with the servants and other employees, the entire plant must take care of at least 750 persons. As the hotel is some distance from any other community, it was necessary to provide for water supply, lighting, and other necessities of modern life.

The present group of buildings consists of the original Chalet, which is built of timber with rooms for 250 persons, and includes, the hotel office and lobby, dining room, tea room, and other social centres, to which is attached the kitchen store room and servants' quarters; a large reinforced concrete wing, on the ground floor of which is, a large ballroom, billiard room, ladies' parlor, and public rest rooms, contains 122 bedrooms; three frame annexes, with bedrooms, unit heating plant, septic tank, dining room and kitchen, with servants' quarters; a laundry and boiler house, with additional servants' quarters in the second storey, and connected with the main groups by a concrete subway; and a group of buildings in the rear housing the livery teams and the ponies.

A system of roads within the group lends an air of formality to the otherwise low, swampy, ground at the end of the lake upon which the buildings are erected. Practically the entire system of trails built by the National Park officials and the Canadian Pacific in this district converge upon the hotel. Transportation to and from the railway is accomplished by gasoline motor cars on 12-in. gauge track, carrying both freight and passengers. Electric light is furnished by a small hydro-electric plant below the hotel, taking water from the lake by a pipe-line. Water is piped by gravity to the hotel from a small lake about 900 ft. higher, supplied principally by the run-off from melting snow and ice. The problem of sewage disposal has been solved by the use of a large septic tank of three chambers, placed alongside the subway mentioned above, and discharging into the overflow from Lake Louise.

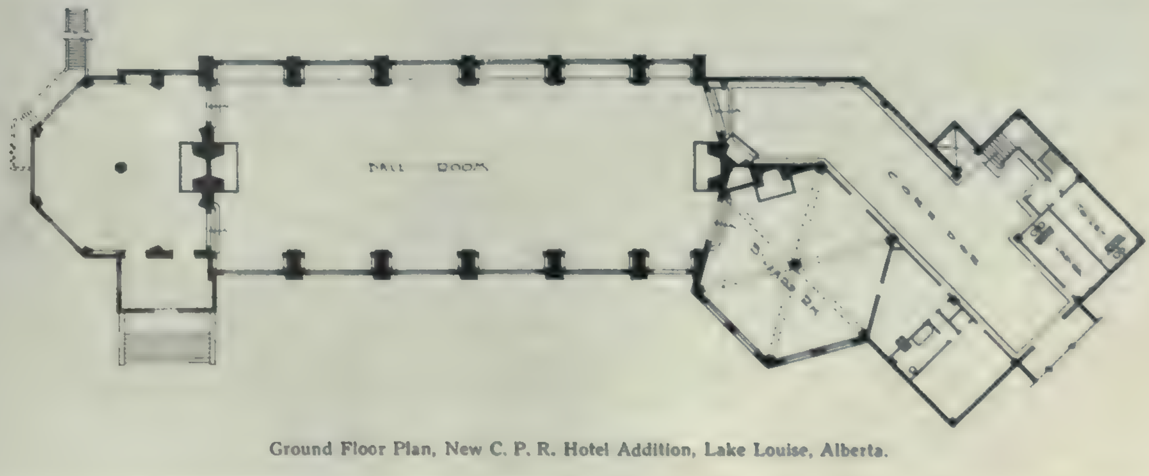
In the winter of 1911-12, work was commenced on

C. P. R. Hotel at Lake Louise, Alberta.—Showing Old Timber Chalet and New Reinforced Concrete Addition.

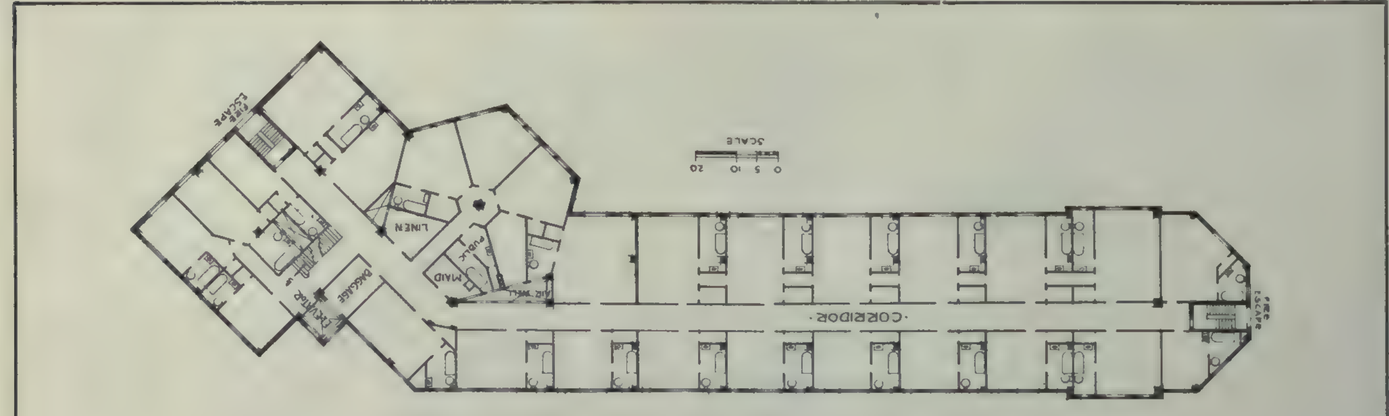
C. P. R. Hotel, Lake Louise, Alberta.—Reinforced Concrete Addition During Construction.

the erection of the three units, two of which are together on the edge of the lake, while the third was erected some distance back, on the side of a ridge behind the Chalet. These buildings are essentially the same in plan, having a length of 160 ft., main width of 40 ft., with service wing in the rear, 28 ft. by 44 ft. They are all three storeys high, containing 31 bedrooms, and 19 private baths, all rooms along the corridors being intercommunicating through the bathrooms. The exteriors follow certain of the Swiss Chalets, two being alike, with rough cast ground floor and clapboards on the upped storeys; wide, overhanging eaves, and low, shingled roofs; the third has boarded ground floor and roughcast plaster above, with steeper roof slopes, and small turrets at intersections. The interiors are finished much alike, using B. C. fir panelling and wainscoting, with rough plastered walls and ceilings. In the big lounging room, the trim is all "carded," and the unusual grains to be had in B. C. fir have been worked into conventional patterns for frieze and coffered ceilings. The framing is of ordinary construction, except in the lounging room, where there is a clear span of 24 feet, bridged by two trussed timber beams on four timber columns, and carrying the floor joists and framing for the storeys above. A single corridor runs the length of the building, with a main staircase in the middle, separating the dining room and lounging room; and other stairs at either end for use in case of fire.

These units cost about $65,000 apiece, with steam and hot water heating systems, electric lighting, and finish. They have about 230,000 cu. ft. of contents, and the cost of 28 cents per cubic foot is about equally divided between labor and materials. The design of these units is such that they can be operated as one, two, or three, units at one time, either in connection



Ground Floor Plan, New C. P. R. Hotel Addition, Lake Louise, Alberta.



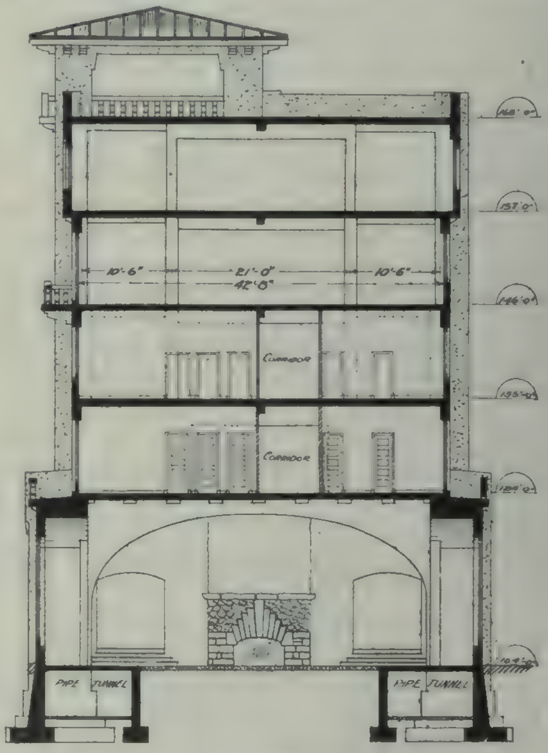
Plan of Upper Flats, C. P. R. Hotel Addition, Lake Louise, Alberta.

with the main Chalet, or independently, as for large parties. One of these units was occupied by H. R. H. the Duke of Connaught and suite during their sojourn at Lake Louise in the fall of 1912.

The fireproof wing is a reinforced concrete structure approximately 265 ft. long on its central axis, 44 ft. wide in the main length, and 6 storeys high, except for a hexagonal tower of 8 storeys. The principal axis of the main Chalet was prolonged until the rising ground was reached, when a turn of 45 degrees was made, bringing the main length of the structure parallel to the hillside. The ground floor is devoted almost entirely to general social life, having a large ballroom, 42 ft. wide by 120 ft. long, ladies' parlor, smoking room, and service rooms, besides private bedrooms. There is a total of 122 bedrooms, 102 private baths, and 8 public toilets, in this wing. All floors are served by an electric elevator; the building is steam heated, has electric lights, and room telephones.

The large ball room occupying the full width of the building without any columns, introduced quite a problem in the structural design of the building. The architectural design called for the use of arches across the room, supporting the four bed room floors above, but the nature of the foundations, part fill and part cut, precluded any such thrust; therefore, a solid 8-in. wall was carried up one storey above the barrel arches across the room, and was designed as a girder having a span of 42 ft., the distance centre to centre of the columns. It was necessary to cut through the wall for the corridor, and in order to have the opening symmetrical, it was made 16 ft. wide, and 8 ft. high. The crown of the architectural arch below was then designed in full tension, the reinforcing bars being carried back into the haunches as for an arch design; while the floor beam over the opening was designed in combined bending and compression. The spacing of beams and arches throughout is 21 ft., dividing the floor areas into square panels, reinforced in two directions. Under ordinary conditions, there would have been a single row of interior columns down the centre of the building, which would have given beams of the same dimensions throughout, but in order to take the concentrated load off the centre of the top chord of the girder, there are two rows of columns in the centre of the building, spaced 10 ft. 6 in. from the centre line. This arrangement required a girder across the corridor to carry the longitudinal beams, and gave very small beams running from the columns to the wall. This idea slightly increased the cost of the concrete formwork. The introduction of the hexagonal tower in the recess formed by the angle in the front wall also complicated the arrangement of the beams. This tower had an inside diameter of 42 ft., and is eight storeys high, with a single column in the centre, floor beams radiating to the six columns of the hexagon. The smoking room occupied the ground floor of this tower, and the floor slab over it is flat; all the other slabs in the tower are triangular in shape, with steel placed in three directions. The tower is 115 feet above the footings, terminating in a peaked roof covered with copper. Beneath the roof there is a water tank of 5,000 gallons capacity, hexagonal in shape and supported upon skeleton beams over the top floor. There are four rooms and two baths on each floor of the tower.

The roof of the main portions of the structure is flat, with a parapet 3 ft. high, and the slabs supporting it were designed for a live load of 125 pounds per square foot, or the equivalent of two feet of melted snow and ice. The outside walls of this building are of concrete, 8 in. thick, poured monolithic with the structural concrete, and reinforced inside and out against temperature stresses. They were bush-ham-



Section Showing Fireplace in Ballroom.

mered by hand, to remove projections, and were then painted with a special cement paint, giving a uniform color. The interior partitions are plastered on terra cotta blocks, using a carpet float, and finished with tinted colors. The interior trim is entirely of B. C. fir. The treatment of the ground floor took full advantage of the concrete construction, all the floors except the dancing floor being of red Welsh quarry tiles, with cement borders. A feature of the large rooms on this floor are the huge fireplaces, built of a true rose quartz quarried at the head of the lake. The cost of the building was $400,000, or about 28 cents per cu. ft.

An interesting feature of the increase in accommodations has been the manner of enlarging the capacity of the electric lighting plant. Originally this plant consisted of a 24-in. S. Morgan Smith turbine wheel, rated at 100 h.p., belt connected to a 75 kw. generator, operating under a gross head of about 90 ft. By going further up the stream to the outlet of the lake, the gross head was increased to about 140 ft., enabling the use of a 100 kw. generator. In order to increase the storage of Lake Louise, to care for times when there would be no apparent run-off, a dam was built at the outlet, raising the level of the lake about 18 inches. The new intake was placed in deep water about 50 ft. in advance of the face of the dam, and from it a 20-inch wood stave pipe connects with the former riveted steel penstock. The dam itself is formed by a bridge of three spans, designed with a spillway section in the middle segment. This bridge forms a part of the road system of the grounds, and consists of three equal arches 18 ft., face to face of piers, with a rise of 16 inches and a width of 21 ft. inside of parapet walls. It cost about $9,000.

The construction of this work was seriously hampered, due to its isolated situation, and having to carry on a large portion of the work during the cold weather. The hotel is generally opened for guests only during the summer months, and no construction work was allowed to proceed during the tourist season. This did not seriously handicap any timber construction, but concrete work was carried on under severe weather conditions, requiring particular care to prevent freezing. In addition to this the distance from the railway handicapped the transportation of materials and often delayed the work. Before construction was completed on the fireproof wing, the narrow gauge railway was put in operation, and better progress was then made. This road has a length of 4½ miles, including terminals, with a 4 per cent. grade, and maximum curvature of 35 deg. It has a gauge of 42 in., with 65 lb. rails. Four gasoline motor cars, constructed in the Angus shops, Montreal, are used for hauling the traffic, carrying 50 passengers, and the other two carrying up to 10 tons of baggage or supplies. The engines are 6-cylinder, 66 horsepower, geared down to a speed of 12 miles per hour on a 4 per cent. grade, and manufactured by the Pierce-Arrow Motor Car Co., of Buffalo, N. Y. The road was constructed by Grant Smith & MacDonnell, of Vancouver, and cost about $180,000, including equipment.

Reinforced Concrete Bridge, Lake Louise, Alberta.

C. P. R. Hotel, Lake Louise, Alberta. Winter Concreting in Progress.

Generally about 350 men were employed upon the construction of the buildings, who had to be housed and boarded without encroaching upon the hotel during the summer, and yet without clearing and establishing a permanent camp. During the severe months of the winter, the men were allowed to be quartered in the servants' wing of the hotel, but this was unsatisfactory on account of the crowded conditions. Finally, a camp was established behind a ridge from the hotel, and permanent cantonments were built, which were occupied for about 18 months.

During the fall of 1911, work of excavating for the fireproof wing was commenced, together with that for the two units along the lake shore. After cold weather set in; excavation was very difficult, owing to the large amount of water present, and it was necessary to keep large bonfires going overnight to prevent the ground from completely freezing. When it is considered that excavation was carried on during temperatures as low as 25 degrees below zero, and concreting during zero weather, some idea of the conditions met with may be appreciated. Concrete was placed for the arches of the concrete wing during the winter of 1911, when the work was abandoned in order to concentrate upon the three units, to complete them for use in the summer of 1912, it being impossible to carry on more than a certain amount of work at one time. The following fall work was resumed, and construction finally progressed at the rate of a storey every two weeks until the concrete work was completed. The work was again delayed for plastering until mild spring weather set in, and the lower floors were ready for occupation in July, 1913. In spite of the handicaps of severe winter weather, isolated position and distance from the source of supply, construc-

(Concluded on page 1288)

Educating the Engineer of the Future

A University does not educate an Engineer, it gives him the means of educating himself—Growing demand for the man of broad experience

By Jno. R. Allen *

THE development of engineering is the most important of all the developments of the last century. Where are the present developments in the engineering world leading us and how are the engineers of to-day and to-morrow to be educated? In the next century are we to continue our development, or is the engineer to rest and stagnate? These are questions in which the educator as well as the professional man should be very much interested.

What would this country or Europe be to-day were it not for engineering science and its development? Our whole so-called civilization of to-day depends for its existence upon the engineer.

Most of the historians have recorded the wars and the changes in the political divisions of earth as the important events of history. But are these the important events? The really important things are those which have changed the morals, the thoughts and the methods of life of the peoples of the earth. Has war ever had much effect upon these?

I lived through two wars in Turkey. One scarcely affected us at all, many of the common people in the interior knowing nothing about it. We did miss a few articles of food and clothing during the Italian war. During the Balkan war the great battle was only ten miles from us, yet we never laid off a man, stopped for an hour or dismissed a college class. It had no important effect on the people. Much of the country was not even disturbed. Most of the disturbance was in the newspapers.

How different from wars has been the effect of the railroad, the steamboat, the telephone and the telegraph? And, in more recent years, the automobile, the phonograph and thousands of other less conspicuous inventions and devices are of no less importance. These products of the engineer have revolutionized modern thought and life. Yes! The engineer is the most important factor to-day in modern warfare, and yet history ignores many of these facts. The engineer is a modest man—oftentimes too modest for his own good.

In all of these rapidly changing conditions of life, what has happened to the engineer? He began as a military man. Then there came to be such a demand for military engineers in civil life that many military engineers resigned to go into civil pursuits and they became civil engineers. With the rapid introduction of the steam engine and steam-driven machinery, the civil engineer was again obliged to specialize and we have the mechanical engineer, and so it has gone on, until now we have:

Military
Civil
Mechanical
Electrical
Marine
Sanitary
Hydraulic
Structural
Railroad
Hydro-Mechanical
Heating and Ventilating
Internal Combustion
Illuminating
Automobile
Efficiency or Shop
Aero-Dynamics

And soon will have submarine and many others. This development in specialization has been very rapid.

The first engineering school was established in this country in 1824, but it was not until 1850 that there was much interest in the development of engineering schools. In Europe, engineering schools were established much earlier. The Ecole des Ponts et Chaussee was established in 1747. The Polytechnische Institut in Vienna was established in 1815.

Rankine less than sixty years ago wrote books on all branches of engineering. Such a thing to-day, even if attempted by as brilliant a man as Rankine, would be laughed at as absurd. In all of the earlier schools the work covered was limited. Even when I compare the courses that I had in college with what is given to-day the changes are very marked.

Fifty years ago most of the successful engineers in this country were self-trained and had not had a college education. They were trained in the school of experience—a mighty good school if one has the time and the energy. Much of the work done by those men could not have been improved upon. One of my old professors made this remark, and I shall never forget it: **"No engineer was ever educated in a University, but the University has given many a man an excellent opportunity to educate himself."** We often forget that, after all, the only real education a man gets is what he gives himself. His teachers can only assist him.

At the present time the field of the engineer has broadened so much that we are confronted with the problem of how to educate a man for a profession when there are fifty or more different lines of specialization open to him, and where the literature turned out every day is more than ten men can digest. In order to better answer this question we must study the work of the engineer.

The Evolution of the Engineer

In the earlier history of engineering his work was largely surveying and digging ditches and canals. Then he commenced to build railroads and power plants. Next he entered the manufacturing field as designer, then as an organizer, and later as an executive. Each year his field has been broadening and the demands for his services in more varied fields of life have been increasing. In the earlier history of the engineer he limited himself to purely technical matters, but slowly his influence is being felt in business matters and in matters concerning public policy. Why not? What better training is there for a manufacturer or a business man than a broad engineering training and experience?

When I was graduated from the University as a mechanical engineer, there were five students in the senior class and we had some difficulty in finding positions. Last year we graduated eighty mechanical engineering students. That was a bad year, and yet, as far as I know, they all have positions, and there are positions to spare. What better evidence can you have of the growing demand for engineers? I used to think that some day all the available positions in the engineering field would be filled and there would be no more openings. But an investigation of what became of the engineers, particularly the mechanical engineers, answered that question.

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* Prof. of Mechanical Engineering, University of Michigan, before the Cleveland Engineering Society.

Of the graduates in mechanical engineering of the University of Michigan who have been out ten years or more, I was surprised to find that:

Ninety per cent. were still in engineering.

Thirty-four per cent. were presidents, vice-presidents, general managers, or general superintendents of manufacturing corporations.

Thirty-nine per cent. were superintendents, chief engineers or sales managers of manufacturing corporations.

Seven per cent. were constructing engineers, professors, patent attorneys, and in special lines.

Twenty per cent. were salesmen, in minor positions or in other lines.

Reach Executive Positions

The statistics show that almost 80 per cent. make good and reach positions of responsibility. What community of untrained men can show such a percentage of success?

These statistics show that with mechanical engineering (and I have no doubt the same is true in other lines) a large percentage of the technical men eventually reach executive positions in our large corporations or large public works, and become men of affairs rather than strictly technical men. Unfortunately I have not the statistics for the other branches of engineering. Recently in looking up the statistics in regard to the appointment of city managers, I was surprised to find that ninety per cent. of the city managers were civil engineers by profession.

These statistics and our own observations all go to show that the technical engineer in this country, as he grows older, becomes more and more the executive in the large corporation or the director of some large public work rather than the technical specialist working under the direction of some men trained in the school of business. This leads to a different view of the training that an engineer should receive from that held by many educators. If he is eventually to become the head of a large business, a man of affairs, his education should be broad, and not narrow, as held by many.

The tendency to give a very narrow training to the engineer is particularly true in Europe, much more so than in this country. In European countries the engineer's training is strictly technical. Almost all cultural studies are omitted and his interests seldom take him beyond his own profession and amusements. The result has been that fewer technical men in Europe are occupying executive positions than in this country. But even in the large European factory you find some technical men occupying important executive positions. The European engineers, on the other hand, are very thorough, very careful in detail, and excellent designers.

From my experience in Turkey in dealing with engineers trained in different countries, I should say, let an American or English engineer conceive the general scheme, but let the German, Italian or French engineer work out the details. Such an arrangement ought to give almost ideal results.

In Turkey I had an old Italian engineer, educated in France, doing detail drawing. The drawings he made were wonderful. I never before or since have had such beautiful detail drawings made by any draughtsman. But, in conceiving a general scheme and in attacking a new problem the foreign engineer often lacks courage to follow his own ideas and hesitates to try anything new.

There are two ideas of what an engineer's training should be: First, shall the student be educated along narrow lines of specialization, or second, shall he be given a broad foundation and specialize in later years as a result of additional study after leaving college?

Personally, I believe the second course the better one for the average student. In general I believe a technical course should give a man a general education in English, modern languages, political economy, ethics, business administration, business law and accountancy, and a thorough grounding in mathematics, physics, chemistry, mechanics and drawing. Particular attention should be given to thorough teaching of these subjects. This foundation should be followed by sufficient courses showing the application of these fundamental principles so that the student will be able to apply his fundamental principles to actual problems. I do not believe in specialization in a four-year college course; or, what is worse, in trying to teach detailed practice in college. Practice is always changing and the engineer will be studying the details of practice all the remainder of his business life. Principles that are correct always remain the same and serve to guide one in the lines of correct practice. The college should always emphasize the fundamental principles. The college should also provide for the engineer who wishes to take up additional work along specialized lines.

It is unfortunate that in many engineering schools the attempt has been made to increase the number of studies and crowd more and more work into the four years. A certain amount of work is all that can be done in four years and there has been a tendency to crowd out the fundamental subjects in order to put in more practical courses. The result is a narrow and one-sided training.

The Group System

About three years ago the Engineering Department at the University of Michigan changed its whole system and adopted what we call the group system. Out of 140 hours credit, 87 hours are the same for all branches of engineering, 30 hours are required in some one of the sub-departments of engineering, and the remaining 15 to 20 hours are for optional or elective courses, of which eight hours are absolutely free electives, subject only to the approval of the head of the department. We are always careful to see that in the optional and elective studies the student does not specialize in any particular group.

With the faculty a reverse policy is adopted. The faculty is specialized. Take, for example, my own department of mechanical engineering. There are six groups besides the general department of mechanical engineering:

1. Steam engineering.
2. Internal combustion.
3. Hydro-mechanical.
4. Heating, ventilating and refrigeration.
5. Shop management.
6. Automobile.

At the head of each one of these groups is a specialist who has practical experience in that line besides special theoretical training. This enables the student, even though he does not specialize, to come in contact with men thoroughly familiar with the detail and theory of the work they are teaching. This is always a great inspiration to the student and his courses are better directed.

There is a danger in this arrangement of courses which must be guarded against. The student, in being broadly educated, becomes superficial. This is particularly true with the American, due to his environment. We live in a big, rapidly growing country and it is easy to see only the big things and forget that these are made up of small details. It is the design and construction of the details that determines the success or failure of the whole.

The greatest criticism that the European engineers make upon the American engineer is that he is apt to be superficial, he does not go into his work thoroughly enough. They admit that the American is wonderful in his conceptions, but say that he is lacking in thoroughness, accuracy and repose. We are too much given to design with a hand book and a trade catalog and do not rely on our own figures. We are too much inclined to hustle when it would be better to go slow. Too many times our hustle only represents lack of good organization.

Our life as a community is reflected back on our student body. The student is anxious to get through as soon as possible so as to get out and chase the dollar. He fails to realize that after he has been out of college a few years no one will ask where he graduated, but will want to know what he can do. The most difficult thing to train into a student is to be thorough and accurate.

There is another criticism I wish to make of the American. He is too provincial. He knows nothing about what is being done in other countries. Many men seem to think that America is the one great engineering country. Three years ago I made a trip through Germany, France and England, visiting only manufacturing plants, and I assure you they have some of the finest plants I have ever visited. There is just one line in which Europe admits we are superior, and that is, in the manufacture of machine tools. In all the best machine shops in Europe, even in Turkey, you see many machine tools. But the European engineer is rapidly copying these tools and improving them. We must look to our laurels if we expect to maintain our superiority even in these lines.

Knowledge of Many Languages

One reason why the European engineer is more generally informed as to what is going on in other countries is because of his knowledge of other languages besides his own. If this country is to be a world power it must know the world. The engineer must not confine his reading and observation to his own country, but must know what other countries are doing.

I believe that the engineer of the future must be broadly educated. He must cultivate habits of thoroughness and accuracy. He must be familiar with the work of other countries in his own line.

There is food for thought in the conversation which I had with a German engineer crossing the Black Sea, which may be summed up as follows:

There are three commercial nations: Germany, progressing; England, on the retrograde, and the United States, asleep.

Let us see to it that the engineering profession shall be the means of waking up this country to its great possibilities. This alone will make the engineering profession the most important one in our modern civilization.

Experiments with Gravel Roads in Iowa

IOWA has been experimenting this summer with gravel roads and in the November Service Bulletin of the State Highway Commission, T. R. Agg, professor of highway engineering of the Iowa Engineering Experiment Station, recounts the methods used and the results obtained as follows:

While the season was an exceedingly bad one for construction work, it being almost impossible to secure strictly high-class results, nevertheless, it is believed that the general method followed will prove entirely satisfactory for most Iowa graveled roads.

While it is highly desirable to secure a gravel containing about 60 per cent. of material retained on a ¼-in. screen and having from 15 to 20 per cent. of clay binder mixed with it, the summer's experience indicates that a good road can be built with any kind of gravel if it be properly handled. On the Fort Dodge road, carrying successfully the exceedingly heavy traffic of the Hawkeye highway, the gravel consisted of pebbles ranging from ½ in. in size down to fine clay. The clay content was about 20 per cent. and only about 40 per cent. of the material was retained on the ¼-in. screen. The pebbles were of good, hard durable material, and the clay was thoroughly mixed with the sand.

On the Spirit Lake work, several different supplies of gravel were drawn upon. Some of the material was exceedingly coarse, contained pebbles up to 3 ins. or more in size and was deficient in bonding material. Other material that was used ranged from about 2 ins. down, was fairly well graded and contained about 15 per cent. of bonding material.

At Rockwell City an exceedingly variable local deposit was used. The gravel contained at least 60 per cent. of sand and 20 to 25 per cent. of clay.

Whatever the character of the material happens to be, good results can be obtained if care be exercised in securing uniform mixing of the materials on the road so that the layer will be homogeneous in character and will, therefore, wear uniformly. It is also important to rake out the larger stones and put them in the bottom layer.

It is believed that no stones larger than will pass a 2-in. ring should be used for the wearing course of a graveled road. If the gravel is deficient in binder, clay or loam from alongside the road can be added to the surface and harrowed in, but care should be taken not to use too much binder.

Preparation of Roadbed

In shaping the trench for the lower course several methods were tried out, some of which did not prove to be very satisfactory. The elevating grader with a short horizontal apron, was used for a few days and apparently will prove to be very satisfactory for this class of work. The material which was excavated in forming the trench for the lower course was delivered by the apron far enough out at the side to form the shoulders for the upper course. Unfortunately, the machine that was being tried out broke down before conclusive ideas had been arrived at as to the exact manipulations necessary to complete a roadbed by this method. Later, the trench for the lower course was plowed by means of the tractor and a heavy road plow, and the material thus loosened was graded out to form shoulders for the upper course by means of a blade grader. This method did not prove to be very satisfactory, because the tractor repacked the material that had been loosened during the plowing, and it was difficult to finish the grading without additional plowing. At another place, the heavy scarifier was used to loosen the road surface, and after it had made a few rounds, the loosened material was graded out with a blade grader for shoulders. Probably the following methods can be used satisfactorily: 1. Elevating grader with horizontal apron. 2. Scarifier and blade grader. 3. Road plow and blade grader, if each furrow is graded out as soon as plowed.

Rolling the Roadbed

After the roadbed has been shaped it is thoroughly rolled with a roller weighing at least 10 tons. The purpose of the rolling is twofold: 1. To compact and seal the roadbed so as to make it as nearly waterproof as possible. 2. To develop any fundamental weaknesses in the foundation if such exist. These latter will be evident by spongy places that will not compact. When such places exist before the gravel is placed and are not discovered the gravel road will eventually develop a depression at this point. Probably it will cut through. The cause of spongy places is usually water, either held in a pocket surrounded by impervious clay, or underground water flowing near the surface. In any case it is important to discover the presence of poor foundations before the gravel is placed and to take whatever measures are necessary to correct the condition before placing the surface.

Experience has shown conclusively that one cannot regularly compact a layer of gravel that is more than 6 ins. thick. For that reason a gravel road should be constructed in two layers, each of which will be about 6 ins. thick before compacting. When the road is built to the Iowa Highway Commission standard the lower course will be 8 ft. wide.

In order to get just the right amount of material in the roadbed the wagon should be measured and the distance should be computed. The dumper should then be given a stick of the length that a load should spread or should be given a cord of the right length with a stake at each end. If the loads are dumped the right distance apart spreading is considerably easier and when completed the builder is assured that he has the proper thickness of gravel. The spreading may be done with shovels or with rakes as fast as the loads are dumped. But if the hauling is being done by a large force it may be more convenient to dump a number of loads of gravel and then spread them with a blade grader. For this work a light grader that can readily be drawn by two horses is better than a heavier machine.

Harrowing Mixes Material Evenly

After the gravel has been spread it should be thoroughly harrowed to evenly mix the material. Everyone knows that the ordinary gravel is exceedingly variable in composition, and that even material hauled from a single pit will vary from load to load. If, however, the material in the road is thoroughly stirred up a sufficiently uniform texture can be secured to give reasonable uniform wearing qualities. The harrowing has another important function, that is, to distribute thoroughly the bonding material through the mass. This bonding material is often clay from the overburden, or from dirty gravel, that is mixed with the better material. Sometimes it is clay that is thrown upon the surface from alongside the road.

The most satisfactory harrow is one that is made of 1¼-in. round iron, spaced about 6 ins. apart and extending 8 ins. below the frame. The harrow is arranged to be drawn by one corner and weighs 250 to 300 pounds. The teeth must be long enough to stir thoroughly the entire thickness of the layer.

After the gravel has been spread and harrowed it is rolled once over. At this stage it will have a wavy appearance due to the fact that in spite of the utmost care there is a lack of uniformity in the spreading and some difference in the density of the layer of gravel. The blade grader is run over the surface dragging the high spots and depositing the material in the low places. Two or three rounds are necessary to produce the desired uniformity. It is important, however, to take very light cuts with the grader, dragging only a small amount of material along the surface. When once the blade is set it should not be shifted again during the round, otherwise additional uneven places will be formed. The roller is then run over the surface for another round or two and the grader again used to smooth the inequalities. On the work done during the past summer it was usually found necessary to repeat this operation four or five times. But this was due to the unusual weather conditions which made it impossible to secure as favorable a foundation as would ordinarily be the case. Probably during an average season, three times over with the grader between rolling will be enough.

The important thing is to get the gravel so well spread that it rolls down uniformly. As soon as this stage is reached the rolling is carried on continuously until the layer is thoroughly compacted. If the gravel has been placed during dry weather and continues to dry out after being placed on the roadway it is useless to attempt to compact it with a roller or by any other means. It should be kept in shape by frequent trips with the grader until a rain wets it sufficiently to permit rolling. This may be a considerable time at certain seasons of the year, but if the gravel has been spread between suitable earth shoulders the traffic cannot spread it out over the roadway and waste it during the period when it is too dry to pack. When it does receive enough water to pack properly the roller will finish many feet of road a day. During the period when the road is being kept in shape the grader should be used in preference to the drag. The drag has a tendency to increase the waviness of the surface unless provided with runners.

Early Maintenance Prevents Ruts

No matter how carefully a gravel road has been built it will not be possible to produce the stability and density of texture that would result from years of traffic. During the first year, especially, traffic will have a tendency to form ruts or depressions in the road surface. Unless these are taken care of immediately upon their appearance they are liable to become a permanent feature of the surface. As the gravel gradually seasons it becomes increasingly difficult to remove depressions or ruts and the economical thing is to prevent the formation of them. This is best accomplished by an occasional trip with a light blade

(Concluded on page 1286)

Country Road-Building Experience

Construction and Operation Methods used in the County of Los Angeles, California—Comparison of three types of roadway

A detailed description of Country Road building practice and operation in the County of Los Angeles, Cal., is given in a current issue of Good Roads, from which extracts are printed below.

Construction

The types of road most generally used in the county are oiled earth, oiled macadam, concrete and concrete with a bituminous wearing surface.

Oiled Earth Roads

The common method of treating earth roads in the county is as follows:

The roadway is first shaped to the desired grade and crown, this work being carefully and thoroughly done. An oil containing approximately 70 per cent. of asphalt is then applied at the rate of 1 gal. per sq. yd. of roadway. This first application of oil is allowed to remain on the road for a day or two, after which the road is thoroughly cultivated with toothed and disc harrows to a depth of from 4 to 6 ins. The road is then reshaped and a second application of oil made at the rate of 1 gal. per sq. yd., after which it is again cultivated and given a third treatment of oil, the same amount being applied as before. The road is then finally reshaped with a grader and rolled with a 10-ton roller or a 2-ton sectional horse roller, or, if that is not obtainable, with such hand rollers as may be available.

A road constructed in this way, it is stated, will carry light traffic for a long time, and will carry medium traffic satisfactorily for about a year, but will not last long under heavily loaded wagons. The life of the road depends largely upon the rainfall as well as the amount of travel. There are roads of this kind in the county which have been in service three years without a second oiling and are still in good condition. There are others, subjected to heavy traffic, which go to pieces faster than they can be oiled.

Oiled Macadam Pavement

The standard specifications of the county for oiled macadam are as follows:

Upon the roadbed prepared as hereinbefore described broken stone of such sizes as the Road Commissioner may direct shall be spread in layers or courses of a width, thickness and cross section, which, after being thoroughly compacted by watering and rolling, shall conform with the standard cross section mentioned in paragraph two (2) hereof. Each course shall be rolled separately and evened up with material of the same size as the course.

The sprinkling and rolling shall be continued until each course is thoroughly compacted, until the stone ceases to sink under the roller or creep in front of it, and until a heavily loaded wagon may be driven over the surface without cutting it up. The surface of each course must be uniformly smooth and conform to the required grade and cross section. Then one or more light applications of stone screenings or sand shall be uniformly spread over the surface and swept in with street brooms, in sufficient quantity to fill all voids. It shall then be watered and rolled and the application of stone screenings or sand, watering and rolling continued until all voids are filled and until the stone screenings or sand are uniformly one-quarter (¼) inch below the surface of the course and until the stone is firmly locked together and of such strength that it will carry a motor truck having a load nine (9) tons on the rear axle without showing any appreciable wheel marks.

After the upper course prepared as above specified has dried to a depth of one (1) inch, heavy asphaltic oil shall be applied at the rate of one-half (½) gallon per square yard of surface covered, after which stone screenings or sand shall be uniformly spread over the oiled surface in a thin, uniform layer in sufficient quantity to thoroughly bind the wearing surface of the stone and form a true surface; the interstices shall be filled to the surface, but the screenings or sand shall not extend more than one-fourth (¼) inch above the surface of the larger stone after thorough watering and rolling. Then a second coating of heavy asphaltic oil shall be applied at the rate of one-half (½) gallon per square yard of surface covered. A light coating of screenings or sand shall then be uniformly spread or drifted over the surface in sufficient quantities to absorb all surplus oil and produce a uniform surface with no oil exposed and no patches of excess screenings or sand. The pavement shall then be thoroughly watered and rolled until it becomes hard and smooth, true to grade and cross section, and free from all hollows or irregularities.

All broken stone and screenings or sand shall be shoveled into place from a dumping platform or from the wagon, or spread by a self-spreading wagon, or distributed by a bottom dump wagon, according to the directions of the Road Commissioner.

The finished pavement shall be hard, uniformly smooth and true to grade and cross section.

Broken stone shall not be deposited upon the subgrade for a greater distance than one-fourth (¼) mile ahead of the first application of oil except by written consent of the Road Commissioner, it being the intent of these specifications to keep the work finished as close as possible and not to unduly expose the loose rock to damage from travel, dust, etc.

Oiling

The standard specifications of the county for oiling and the specifications for road oil for both earth and macadam roads are as follows:

The heavy asphaltic oil shall be applied by a pressure spraying machine which will spread the oil uniformly over the surface of the road in a manner satisfactory to the Road Commissioner, using the specified amount of oil per square yard of surface. It shall be applied at a temperature of not less than two hundred and fifty (250) degrees Fahrenheit, nor more than five hundred (500) degrees Fahrenheit.

If necessary to reheat the oil to comply with above requirements, it shall be done and at the expense of the contractor, by use of hot air or superheated steam coils. In no case shall live steam or water be injected into or allowed to enter the oil after it has been received by the contractor.

In the process of oiling, oil must not be allowed to fall on any concrete head walls, curbs, walks or private driveways.

No oil shall be applied until the surface which is to receive it is satisfactory to the Road Commissioner. Before any tank of oil is applied it must be inspected by said Road Commissioner to determine its quantity and temperature.

All wagon tanks used for the distribution of oil shall first be submitted to the Road Commissioner, who will gauge and mark the capacity in gallons of said tanks and determine whether they are suitable for the proper distribution of oil.

At least twenty-four (24) hours shall elapse between any two applications of oil over the same area.

Disintegrated Granite Foundation

A foundation used to a considerable extent for both macadam and concrete consists of a course of disintegrated granite. When used, this is built according to the following specifications:

Upon the roadbed prepared as hereinbefore described, disintegrated granite shall be spread in layers or courses of a width, thickness and cross section, after watering and rolling, as is shown on the standard cross section therefor and mentioned in paragraph two (2) hereof.

Each course of disintegrated granite shall be saturated with water and rolled until thoroughly compacted.

The surface of the finished base shall be hard, smooth and true to grade and cross section, and satisfactory to the Road Commissioner.

Concrete Pavement

The standard specifications of the county for pavement of this type are as follows:—

Roadbed.—The roadbed shall be prepared as hereinbefore specified; also it shall be thoroughly wetted immediately ahead of the placing of the concrete.

Forms.—The forms shall be of two (2) inch redwood lumber, free from warp, the thickness of the pavement, one edge planed straight. They shall be set true to the required lines and grades, and held in place by stakes of such size and length and set at such intervals as may be necessary to insure rigidity. The stakes shall be flush with the upper edge of the side strips and the entire form work constructed in a substantial and workmanlike manner. The forms are not to be removed, but are to remain as part of the completed work. The forms shall be thoroughly wetted or oiled before any concrete is deposited against them.

Whenever it is necessary to stop work, even at noontime, the work must be completed up to a form placed across the roadbed.

Cement.—All cement for the concrete pavement shall be "Portland" cement, conforming with the standard specifications for cement adopted in August, 1909, by the American Society for Testing Materials.

The cement shall be suitably protected from the weather and piled so as to permit of access for tally, inspection and identification of each shipment. It will be delivered in the original package with the brand and the name of the manufacturer plainly marked thereon. The contractor shall be held responsible for the proper protection and safety of the cement after delivery by the County. He shall also collect and make prepaid return shipment of empty cement sacks, and all shortage of cement or sacks shall be charged to his account.

Other Materials.—The concrete shall be composed of broken stone or screened gravel and sand—all of which shall be clean, hard, durable, well-graded—and "Portland" cement, and fresh, clean water.

The sand shall be of such size that all of it will pass through a screen having four (4) meshes per linear inch, and at least forty (40), but not more than eighty-five (85), per cent. by weight, will be retained on a sieve having thirty (30) meshes per linear inch. Not more than seven (7) per cent. by weight shall pass through a sieve having one hundred (100) meshes per linear inch.

The broken stone or gravel stones shall vary in their longest dimensions from one-half (½) of an inch to two and one-half (2½) inches.

Composition.—Concrete materials shall be proportioned as follows: One (1) cubic foot (94 pounds) of cement, two (2) cubic feet of sand, and four (4) cubic feet of broken stone or screened gravel, and water, which shall be added in such proportions as the Road Commissioner may, from time to time, determine.

Mixing and Placing.—If the concrete is mixed mechanically, a mixer shall be used, into which the materials, including the water, can be precisely and regularly proportioned and be thoroughly mixed.

Hand-mixed concrete shall be mixed on a tight, level platform as follows: the cement and sand shall first be thoroughly mixed dry in the proportions specified. Clean water shall then be added and the materials thoroughly mixed, and deposited on the broken stone or screened gravel, which has been previously drenched with water. The ingredients shall then be thoroughly mingled and turned over until each stone is covered with mortar. The batch shall be carefully deposited without delay and thoroughly rammed until the water flushes to the surface and all the voids are filled. Should defective work be discovered it is to be removed and the space refilled with fresh material as directed by the Road Commissioner. No allowance shall be made for any materials or labor necessary on account of water.

Finish.—The concrete is to be brought to a true and uniform surface conforming to the grade and cross section of completed roadway, as shown on drawings, by means of templates and such other implements as may be necessary. While the concrete is still plastic, it is to be finally finished with steel floats and given a granolithic surface, which must be free from any unevenness.

During the first fourteen (14) days after placing, the concrete pavement shall be kept constantly flooded by impounding water within a series of earth dams and earth banks constructed at such locations and in such a manner as the Road Commissioner may direct.

All concrete shall be measured in accordance with the dimensions shown on the plans and cross sections.

Reinforcement.—(If specified in proposal). Shall be woven wire reinforcement of such size, thickness and design as shown on the plans or cross section therefor (similar to the American Steel and Wire Company's triangle mesh reinforcement wire) and acceptable to the Road Commissioner. It shall be laid with the longitudinal wires at right angles to the centre line and one and one-half (1½) inches above the bottom surface, allowing each sheet a two (2) inch lap.

Concrete pavement will be paid for at the unit price per square yard for concrete pavement in place complete, which price shall include the furnishing of all materials, all labor, tools, implements, forms and all work on same, and everything incidental and necessary to the completed work, except as herein otherwise specified.

Bituminous Wearing Surface

Bituminous wearing surfaces for concrete pavements are constructed in accordance with the following specifications:—

After the concrete pavement has been constructed as hereinbefore specified, all dust, mud, earth or foreign material of any kind which may have accumulated upon it shall be removed and the surface flushed with water. When it has become sufficiently hard and dry and in the opinion of the Road Commissioner is ready to receive it, asphaltic oil will be furnished and applied by the County. It will be put on in one application of approximately one-third (1/3) of a gallon to the square yard. All the work hereinbefore and hereafter provided for shall be performed by the contractor except the application of asphaltic oil.

Directly after the oil has been applied, stone screenings of the commercial size known as Number Four shall be uniformly spread upon it in sufficient quantity to combine with the oil without leaving any excess screenings on the finished road surface. The stone screenings are to be spread in a direction parallel with the road and never crosswise. If necessary, from time to time, additional screenings shall be spread, as the Road Commissioner may direct, to cover any oil which may come to the surface, until the final completion and acceptance of the work. The stone screenings are to be furnished and spread by the contractor and must be of a quality, size and spread in a manner satisfactory to the Road Commissioner.

Maintenance

For maintenance purposes the roads of the county are divided into two classes—paved ways and earth roads, the latter comprising all roads in the county except the boulevards or paved ways. The work of maintenance is classified under three heads—ordinary maintenance, extraordinary maintenance and special maintenance—and is all carried out under the direct charge of the Superintendent of Maintenance.

Ordinary maintenance is carried on under the direction of district engineers, of which there are at present three. This work consists of small patchwork, the repair of holes not exceeding 3 yards in surface area, the filling of ruts and depressions, the removal of loose stones and, in fact, any work of this character not necessitating scarifying, and also all resealing of the paved part of the road. The upkeep of the shoulders, gutters, culverts and guard rails and fences is also considered a part of ordinary maintenance. The work is done by patrol service, modeled after the French system, but modified by the substitution of the motor truck for the horse-drawn vehicle. It is found that a gang of six or eight men, with a motor truck equipped with a small pump for handling oil and with shovels, rakes, hoes, tampers and other tools, can do the ordinary small repairing necessary to keep the road surface in a satisfactory condition on a stretch of from 50 to 75 miles.

Big Balance Now on Right Side

	1913	1914	1915
Canadian Imports, year ending Oct.	$680,126,591	$607,441,535	$478,208,581
Canadian Exports, year ending Oct.	$447,156,108	$479,126,831	$669,330,590

Canada thus can show the handsome credit trade balance of exports over imports for the year ending Oct. 31, 1915, of $191,122,009.

Extraordinary maintenance comprises large patchwork jobs which may require scarifying; resurfacing work on pavements in a rough or bad condition for distances not less than 200 feet in length; the reconstruction of worn-out pavements for similar distances, in which the use of new material is necessary, and the renewal of parts of culverts, guard rails and fences.

Special maintenance comprises all work in the nature of new construction, such as putting in new culverts, guard rails and fences where none previously existed, and also the repair of damage resulting from flood, storms or similar causes.

Stone and Oil Plants and Equipment

The Road Department at present operates two quarries and crushing plants, which provide most of the crushed stone needed for construction and maintenance work.

The equipment owned by the department includes 4 steam shovels, 16 steam or gasoline rollers, 3 traction engines (which may be converted into steam rollers), 8 motor trucks, 3 oil trucks, concrete mixers, pile drivers, and various implements required for ordinary road work.

At present there is under consideration a plan for increasing the facilities of the county oil pit so that the department can handle all grades of oil, and for constructing a refinery so that the oil can be taken direct from the wells. The three motor trucks referred to are equipped with tanks, pumps, etc., and are used for handling the heavy oil. The lighter oil is handled by gravity sprayers drawn by horses. If, however, the haul for lighter oil is too long to be economically handled with these, one of the other machines is used. In addition to the county oil pit, there are several heating stations at various points in the county where oil is received direct from the refineries at the wells, thereby saving a second freight rate for shipping the oil out from the county oil pit. It is expected that before another year the county will have sufficient equipment to enable it to do all of the oil handling with its own forces. It has been found, it is stated, that the county can haul and distribute the oil with its own machines for about one-half what it is necessary to pay contractors for doing such work. The oil is a very important material in the county work, and it is believed that it is much safer to handle it with the county's own forces.

A comprehensive traffic census has not yet been taken by the county, although during the past year counts have been made on practically all the main highways. On some of the roads a census was taken two or three times during the year. In order that some real value to those responsible for the construction and up-keep of the roads might be obtained, it was decided to make the count extend over the entire twenty-four hours of the day and then reduce the record to a foot-ton basis. This was done and the record for the road in question shown graphically, the record being so drawn as to show the amount of horse-drawn traffic, the amount of motor traffic and the amount of the two combined. Road Commissioner F. H. Joyner discusses the effect of traffic as follows:

"It has been found that the foot-ton traffic varies directly with the actual wear on the roads, as shown by the surface condition of the road and by careful examination of the entire thickness of the road crust, and it does not appear that the weight or the speed materially affect the amount of wear, excepting as they affect the foot-ton load that the road is carrying. Of course, where foundations are weak, either through errors in construction or from other causes, such as the burrowing of animals, a single 10-ton load will occasionally cause the macadam to break under the load where it would not break under five 2-ton loads, but this has been found to be a rare exception. As a rule if a 10-ton load will develop a weakness in the foundation, five 2-ton loads will develop the same weakness. It is believed that this traffic census will enable the department to know what repairs and construction are going to be needed in the years to come, and knowing that, we will be able to provide for funds necessary to meet our maintenance expenses."

The Tunkhannock Valley Viaduct

Total length 2375 feet—Maximum height 240 feet—
Ten spans 180 feet long 165,000 cu. yds. concrete

The Delaware, Lackawanna & Western R. R. has just placed in service its new 39.6-mile cut-off between Clark's Summit and Hallstead, Pa., constructed at a cost of about $12,000,000. Although the new three-track line does not deviate widely from the old location, its maximum divergence being about 1½ miles, it saves a distance of 3.6 miles, and greatly reduces the grades and curves. The maximum grade has been reduced from 1.23 per cent. to 0.682 per cent., while the curvature has been reduced from a total of 3,970 degs. to 1,570 degs. The principal structures along the new line are the Nicholson Tunnel, a double-track bore 3,630 ft. long; the Martin's Creek Viaduct, a three-track concrete structure having a maximum height of 150 ft. and a length of 1,600 ft.; and the Tunkhannock Creek Viaduct.

One of 180 ft. spans Tunkhannock Viaduct.

The dominant feature of the new line is the Tunkhannock Creek Viaduct, a double-track structure having a length of 2,375 ft. and a maximum height of 240 ft. This viaduct is composed of ten 180-ft. and two (buried) 100-ft. semi-circular arch spans springing from solid piers founded on bedrock. The divided arch ring supports transverse spandrel walls, upon which rests a floor system consisting of semi-circular spandrel arches. The magnitude of the structure and the architectural treatment of it are clearly shown in the figure, which is a close view of the second span from the north end. The following data on this viaduct are of interest:

The deeper piers have a section of 40 x 46 ft. below the ground surface, while above ground all piers are 36 ft. 6 ins. by 43 ft. 6 ins. up to a plane 17 ft. 6 ins. below the springing line of the arches. The deepest pier extends 98 ft. below the ground surface, and at this pier it is 304 ft. from the bottom of the foundation to the highest point of the masonry.

The 100-ft. span at each end, termed an abutment span, is entirely buried by the approach embankments. Each end span is composed of two arch ribs, 5 ft. 6 ins. thick at the crown and 12 ft. wide. These ribs are spaced 22 ft. on centres, leaving a 10-ft. space between them. The two ribs of each span are tied together with four reinforced concrete struts. They support reinforced transverse walls, on which rests a reinforced concrete floor slab varying in thickness from 1 ft. 9 ins. to 2 ft. 6 ins. The floor slab extends a few feet beyond the crown of the arch, and the space between the arch ring and the floor slab is closed with an 18-in. longitudinal curtain wall along each outside face, so that when the embankments are completed these abutment spans will have the appearance of U-abutments.

Each 180-ft. span is composed of two arch ribs, 8 ft. thick at the crown and 14 ft. wide. These ribs are spaced 20 ft. on centres, leaving a 6-ft. opening between them. The ribs carry reinforced transverse spandrel walls which vary in thickness from 3 ft. 2 ins. to 4 ft. 8 ins. The spandrel walls are arched over the space between the ribs and carry a floor system composed of 13-ft. 6-in. semi-circular spandrel arches having a thickness at the crown of 1 ft. 9 ins. The parapet wall, which extends the entire length of the viaduct, rises 7 ft. 3 ins. above the viaduct floor, while the pilasters at the piers extend 3 ft. above the top of the pilaster walls. The viaduct contains 165,000 cu. yds. of concrete and 1,200 tons of reinforcing steel.

At a meeting of the Vancouver branch of the Canadian Society of Civil Engineers on the evening of December 2, Mr. Fowler, consulting engineer, Seattle, delivered an address on "The Great Bridges of the World."

"After the war, a readjustment of trade conditions is to be expected. The flood of wealth which has attended the export of munitions and war supplies must of necessity be largely curtailed, and a new set of problems will have to be faced. As I have said on former occasions when I have had the pleasure of addressing you, if economy be exercised to meet the increased burden of taxation, of which we must bear our share, and the production of exportable articles increased to the utmost extent, to protect our gold supply and minimize our borrowings, and if we keep strong in working capital, then, no matter what difficulties the future may have in store for us, we can look forward to them with a degree of complacency."—President's address, Annual Meeting, Bank of Montreal.

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*Engineering and Contracting.

Progress of Bloor St. Viaduct, Toronto

Work well in advance of schedule—Concrete foundations practically ready for steel superstructure—Construction details described

THANKS to the unusually open fall weather, contractors on the concrete foundation work of the Bloor Street Viaduct, Toronto, have been able to rush construction right up to the present time. As a result they are considerably ahead of schedule and practically ready for the steel superstructure, the erection of which will be commenced early in the new year.

It will be remembered that this viaduct is an extension of Bloor Street East, designed to supply a means of exit from the city at its north-east corner and to provide a more direct route to the heart of the city from the section surrounding Danforth Avenue—a section already served with a municipal car-line, but somewhat isolated on account of the deep Don River ravine which runs in a north and south direction through the eastern portion of the city, and by the first Rosedale ravine which runs south-east by south, and merges into the Don Valley.

An extension of Bloor Street directly east would cross these two ravines a little above their junction point. It would also cut the Rosedale ravine at a long angle. For this reason the engineers decided to deviate the course of the new roadway slightly, and according to the approximate plan shown in Fig. 1. Section A, shown here, is simply an earth-fill along the south bank of the steep ravine. B is known as the Rosedale section of the viaduct; it crosses the Rosedale ravine approximately at right angles. C is a section of ordinary concrete roadway crossing the projection of land which runs down to a point between the two ravines. D represents the viaduct crossing over the Don Valley, the longest stretch of the new roadway.

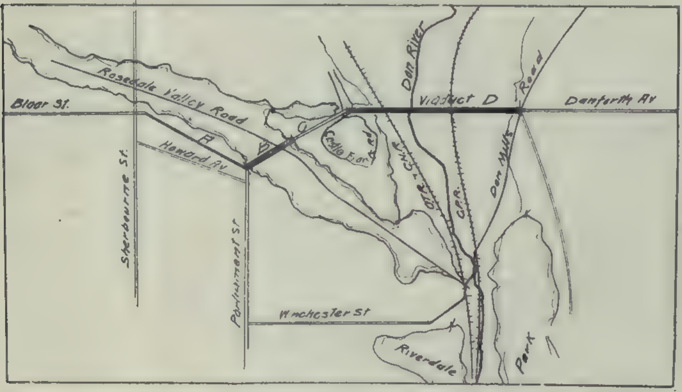


Fig. 1.—B and D represent respectively Rosedale and Don sections Bloor Street Viaduct, Toronto.

It will also be recalled that after mature consideration as to the relative merits and costs of concrete and steel it was decided to build both sections of this viaduct of steel superstructure resting on concrete footings. The present article deals entirely with the concrete, work on which is practically complete on both sections, this work having been carried on simultaneously, though by different contractors.

Commencing at the east, on Danforth Avenue, the viaduct crosses the Don Valley by a steel superstructure carried on a substructure consisting of seven mass concrete piers with five steel spans and approaches of steel trestle work to a point in Rosedale due west of Danforth Avenue. From here to a point on Castle Frank Road on the north-east bank of the Rosedale Ravine a common paved roadway will be laid. The viaduct then crosses the Rosedale Ravine on a similar structure to the Don Valley section to a point at the head of Parliament Street produced, intersecting here with a paved causeway built on an earth-fill on the south-west side of the ravine from the corner of Bloor and Sherbourne Streets.

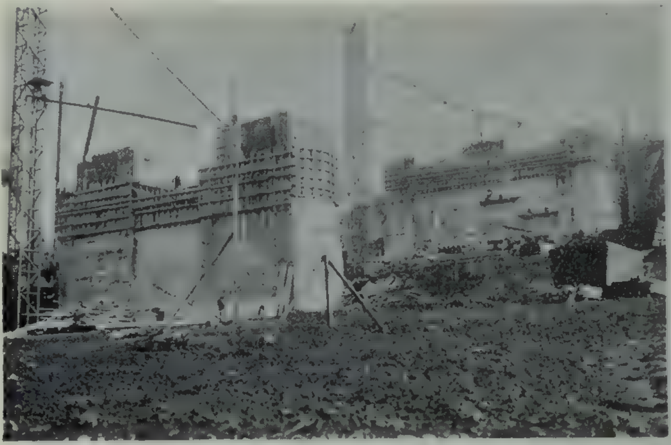


Fig. 2.—Piers A and B, Don section, Nov. 26, 1915.

The contract for this earth-fill has not been let to any firm, the idea, when the contracts were awarded for the viaduct, being to advertise the fill for a dump for clean earth from building construction, and to use it as a dumping ground for earth excavated in the Rosedale section of the viaduct, and to let the contract only if found necessary when the rest of the viaduct was completed.

Don Valley Section

The Don Valley section of the Bloor Street Viaduct is 1,680 ft. long, including the eastern and western approaches, and 125 in height above the Don River.

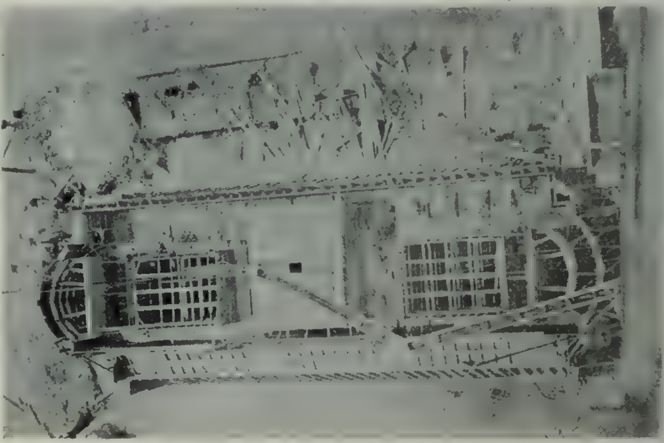


Fig. 3.—Pier D—Photo taken from cement tower.

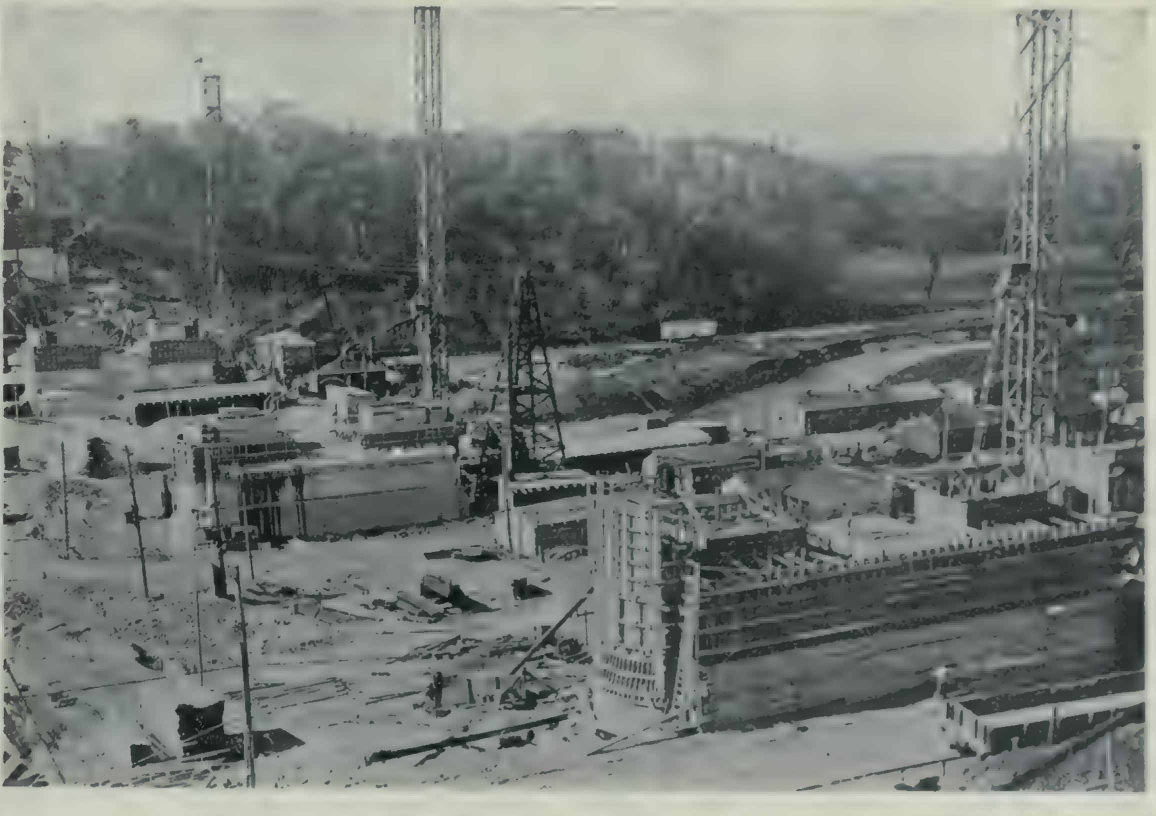


Fig. 4.—Bird's-eye view Don Section Bloor St. Viaduct, Toronto, from Danforth end, Oct. 21, 1915.

The bridge proper is 1,077 ft. 6 ins., and consists of five steel spans. .There are seven piers, commencing from the east with pier A. All piers are lettered consecutively.

The central span over the Don River from pier D to pier E is 281 ft. 6 ins. centre to centre of pins; the first pair of spans on each side of this, C-D and E-F, are 240 ft. centre to centre of pins, and the next pair, B-C and F-G, 158 ft. centre to centre of pins. This constitutes the bridge proper. The west approach has an 80-ft. steel span with cement side walls and suspended cement ceiling, and the east approach consists of steel trestle work with cement side walls. The four arches of each main span rest on large granite blocks embedded in the concrete of the footing of each pier.

Work commenced on the Don section on January 16, 1915. Work since January has been carried on continuously to the middle of December. The substructure has been practically completed before the advent of cold weather, and construction work along this line has now been stopped till after the erection of the steel superstructure, when the balance of the concreting will be completed. All foundation footings in the Don section are in, and about 60 per cent. of the total amount of concrete is already placed, 26,000 to 27,000 cu. yds. of concrete having been poured in the various piers. Practically 40 per cent. of the Don section is ready for the erection of the steel. All excavations for caisson work have been finished, and the only excavation work that remains to be done is the dressing of the eastern and western slopes and grading around the foot of the piers. About 43,000 cu. yds. of earth have been moved in the various excavations.

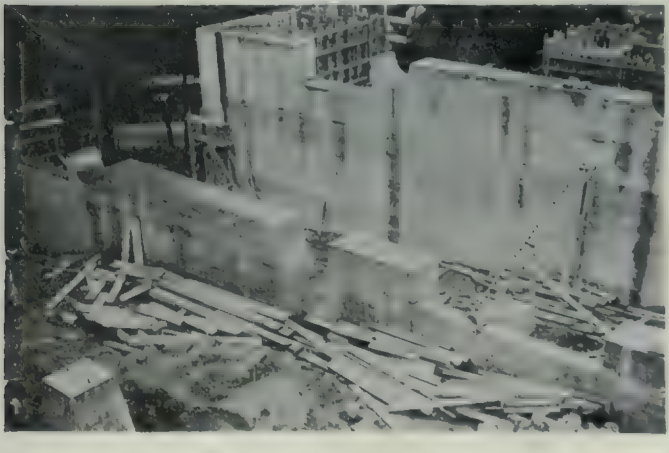


Fig. 5.—Pier H, Rosedale section, Oct. 14, 1915.

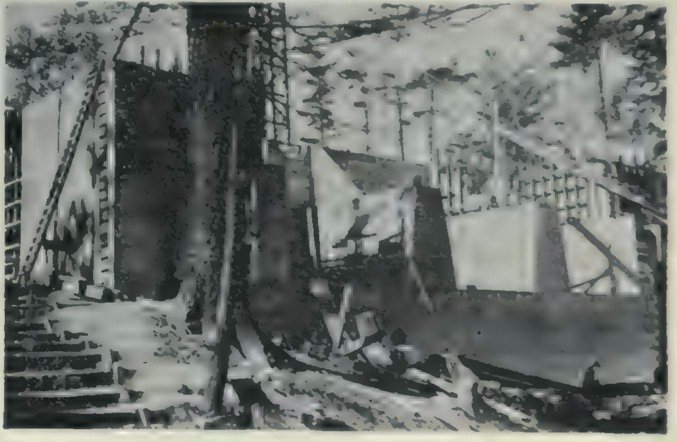


Fig. 6.—Pier J, Rosedale section, Sept. 22, 1915.

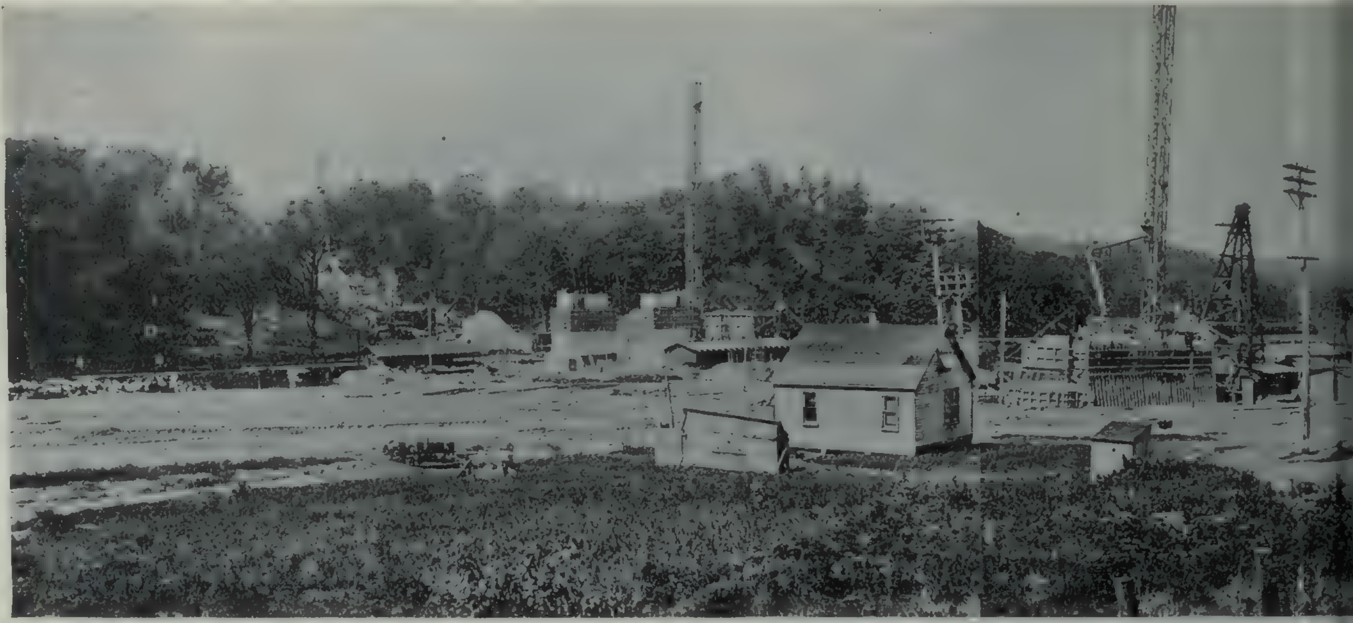


Fig. 7.—Bloor Street Viaduct, Toronto--Panoramic view of the Don

The four piers, C, D, E, and F, in the centre of the bridge proper are set on solid rock. Excavation for these piers was done by the open caisson method. The top surface of the rock found here was a shaly layer of limestone, which was very soft and disintegrated, necessitating that the excavations be carried down from three to five feet further to obtain a solid rock bed.

The deepest excavation is 47 ft. below the lowest level of the Don Valley. The rest of the cuts vary from 30 to 40 ft. below the surface of the ground in their respective locations. In all caisson work except pier D, Lackawanna sheet steel piling was used for sheeting, being heavily braced to prevent them from caving in. Some little difficulty, the only serious trouble encountered during the construction of the piers, was met with in excavating for some of the footings. Deep layers of quicksand saturated with water were encountered, necessitating a very rigid and tight-fitting form.

In general, pulsometer pumps were used in unwatering the caissons, which in the case of the two piers on each side of the Don was quite a momentous task. The two piers next to the abutments on the west side, near the Rosedale Heights, and one pier next to the abutment on the Danforth approach, rest on spread footings on hard, dry, clay foundations, varying from 10 to 14 ft. below the surface of the ground.

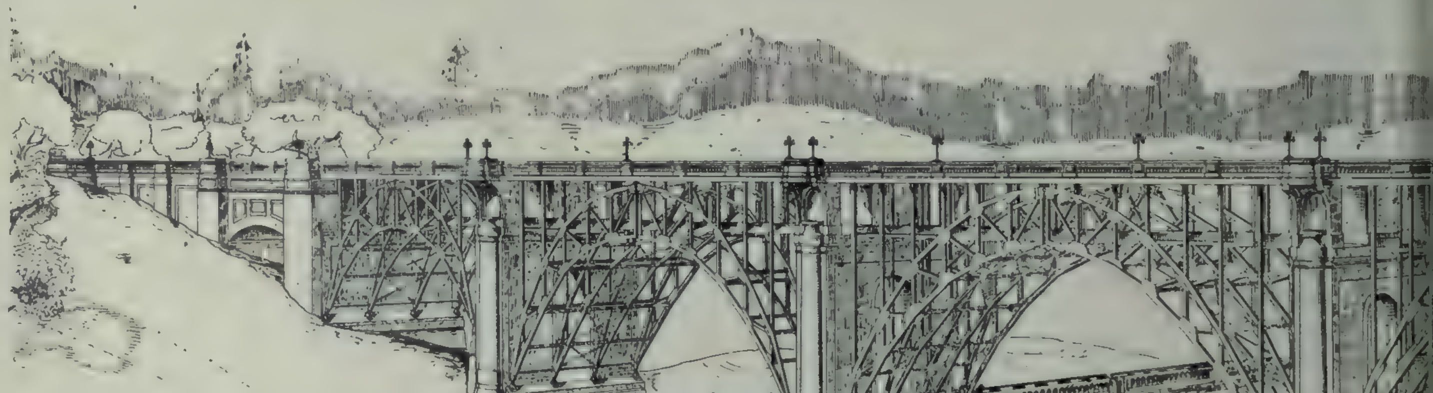
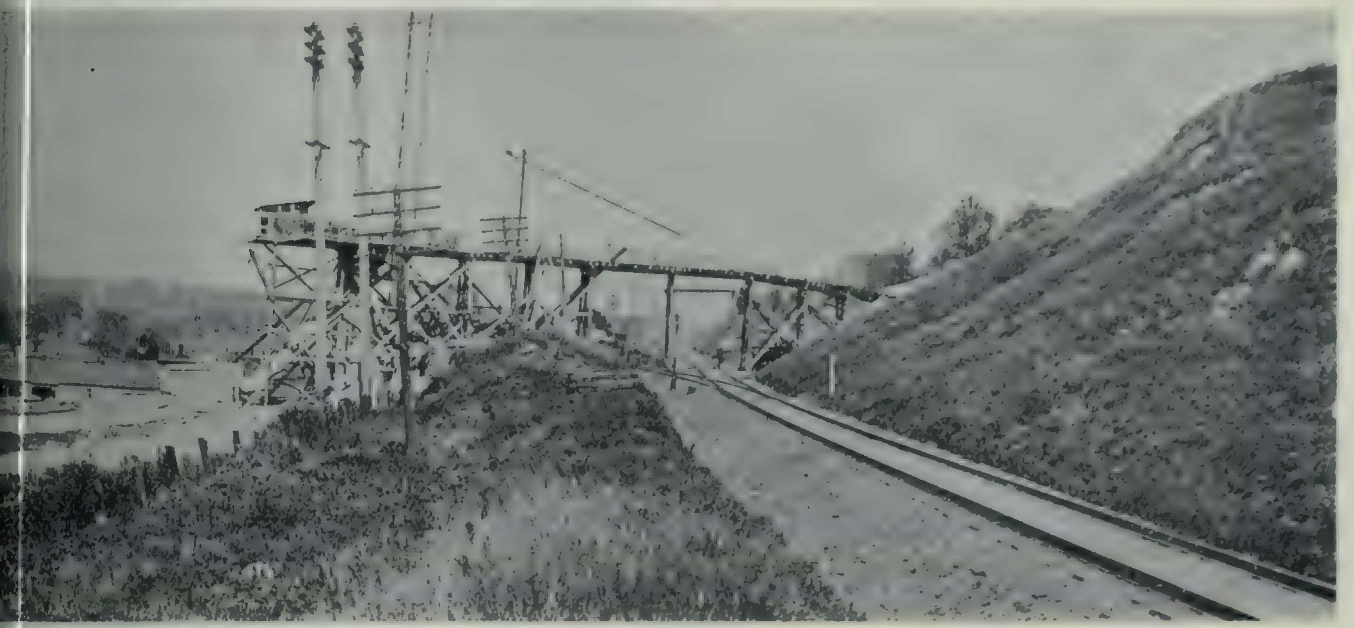


Fig. 8.—Bloor Street Viaduct, Toronto—Perspective of Don Valley Sect



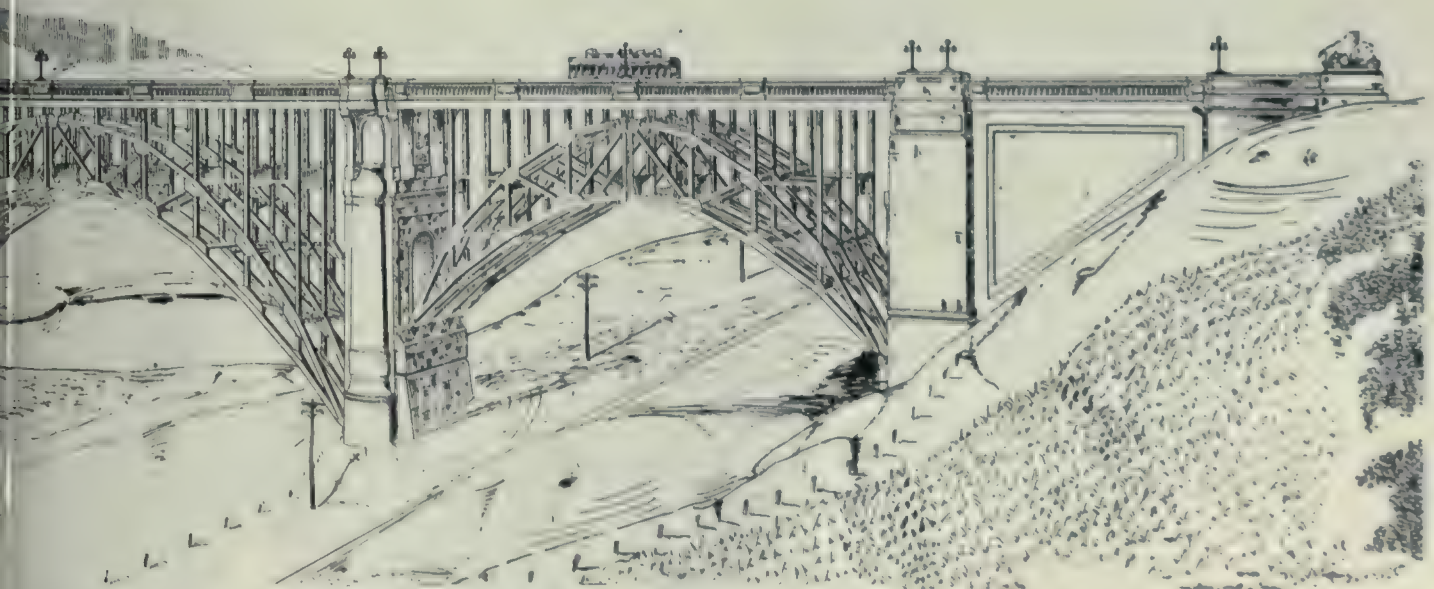
tion, September 10, 1915—C.P.R. tracks at right-hand side.

On the Danforth approach the embankment has been cut away to allow pier A to be placed as far east as was reasonably possible. This was necessary owing to the fact that the C. P. R. runs along the east bank of the valley pretty well up the slope. This was foreseen by the city, and arrangements entered into with the C. P. R. wherein it was agreed to design the viaducts so that the railroad should pass between piers A and B, without any alterations to the present roadbed. This required setting the first pier well into the east bank.

A Marion steam shovel was installed for this purpose and excavated the earth into dump cars which were hauled up an incline over the C. P. R. tracks and distributed from there wherever needed over the Don Valley for grading about the piers and building up low leads. Over 25,000 cu. yds. were excavated and distributed in this way.

The distribution of all excavated matter, aggregate, and material for concrete is handled by a standard 1200-ft. Lidgerwood cable running from the east end of the Don Valley to the highlands in Rosedale. This cable-way, with its bucket, is operated by a two-drum steam hoisting engine situated in an engine house in the Don Valley.

Operations are carried on by means of electric signals, a signaller on the scene of operations giving his signals to the operating room by means of a



ans exposed steel, approach work encased steel—Total length 1618 feet.

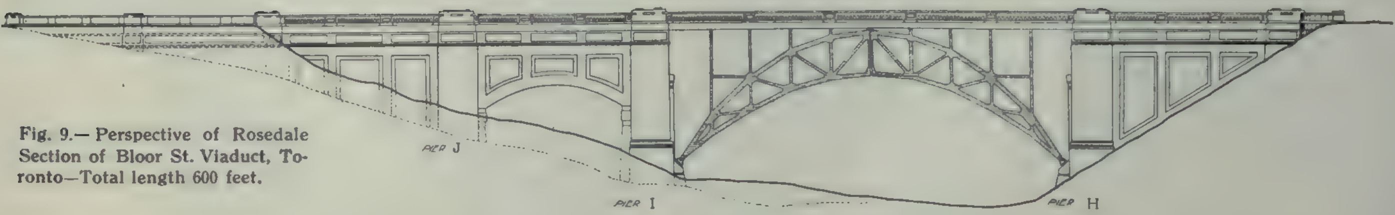


Fig. 9.—Perspective of Rosedale Section of Bloor St. Viaduct, Toronto—Total length 600 feet.

switch. Material for the west portion of the Don section is supplied and delivered on cars on the sidings of the G. T. R. and the C. N. R. on the west bank of the Don. The cement is unloaded on to narrow-gauge hand-trucks, and from them stored in sheds, whence it is distributed to the mixing hopper by the cable-way as required. Sand, gravel, and broken stone aggregate are unloaded into bins or storage piles beside the tracks by clamshell bucket. From there the material is discharged by gravity through chutes into a hopper, and is elevated by means of scoop buckets on an endless chain to the mixing platform. Or it is conveyed directly from the storage piles by means of the cable-way to another mixing plant on the side of the hill at the west end of the viaduct.

A gravity method of distribution is used throughout. Concrete is raised to a point 50 feet above the level of the grade-line of the viaduct by means of five wooden towers placed at suitable points along the viaduct. From these towers the concrete is distributed to the various forms by steel chutes.

Relaying concrete from tower to tower was carried on with a fair measure of success. The aggregate for the east end of the Don section is delivered on the sidings of the C. P. R., where it is unloaded by clamshell buckets and delivered directly to the mixing hopper, and distributed to the various piers.

After the forms have been removed and the concrete sufficiently hardened, a gang is set to work to polish the exterior surface. The large projections are first knocked off, and the surface made fairly smooth with steel tools and carborundum bricks. An electrically-driven carborundum disc operated by two men is then used to give the surface a smooth uniform finish. This work is very slow and tedious.

The construction plant is very modern and complete. It includes a carpenter's shop, with an up-to-date set of tools, a blacksmith's shop, and a machine shop. Storehouses and boarding rooms for the men were erected in the Don Valley during the early part of construction. The main water supply for drinking, boilers, and concrete work is brought from the city mains on Danforth Avenue. In general the plant is steam-driven. Steam boilers placed at different points along the line of the viaduct serve the different hoisting engines and cement mixers. A few small motors, however, are used for driving some

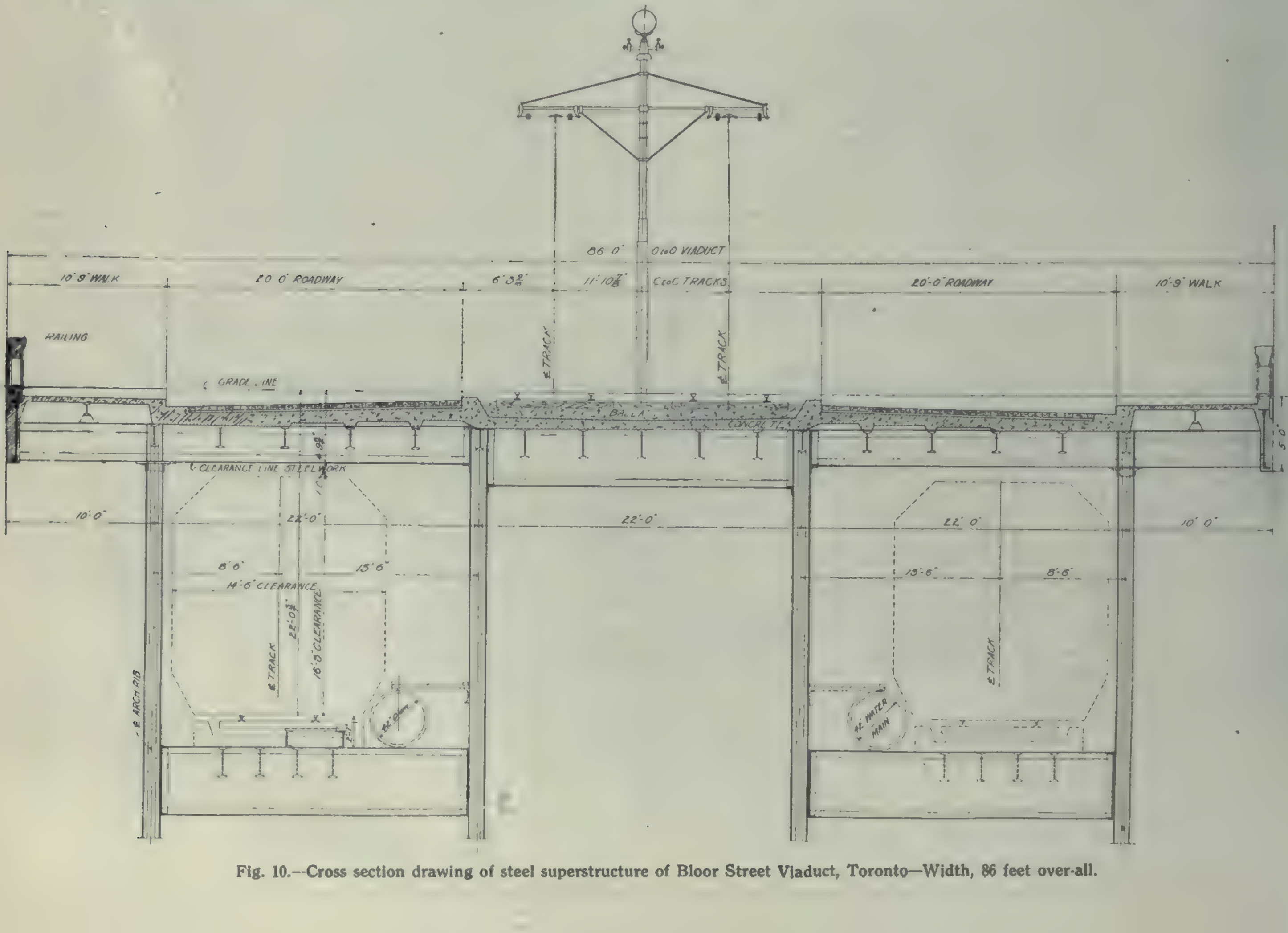


Fig. 10.—Cross section drawing of steel superstructure of Bloor Street Viaduct, Toronto—Width, 86 feet over-all.

woodworking machinery and small tools, a small electric equipment being necessary. The force varied from 200 to 250 men during the season.

The Hamilton Bridge Works Company, Limited, sub-contractors for the steel superstructure, have one steel erection traveller already assembled at the west end on the highlands of Rosedale, and will erect another on the east approach. Erection of the steel will be carried on simultaneously from both ends by two gangs. Steel work is expected to commence early in January, 1916. The general contractors on the Don section are Quinlan & Robertson Company, Limited, Montreal; sub-contractors, Hamilton Bridge Works Company, Limited, Hamilton.

Rosedale Section

The Rosedale section is 600 feet long and 95 feet above the roadway in the Rosedale Ravine. It consists of three main piers, H, I and J, with a steel span of 190 ft. between piers H and I over the roadway, a steel span between piers I and J and with trestle work in the approaches. All steel work with the exception of the 195-ft. span will be enclosed in concrete—that is, with concrete side walls and suspended ceiling arches. This is to give the effect of massive abutments and at the same time avoid the use of heavy retaining walls.

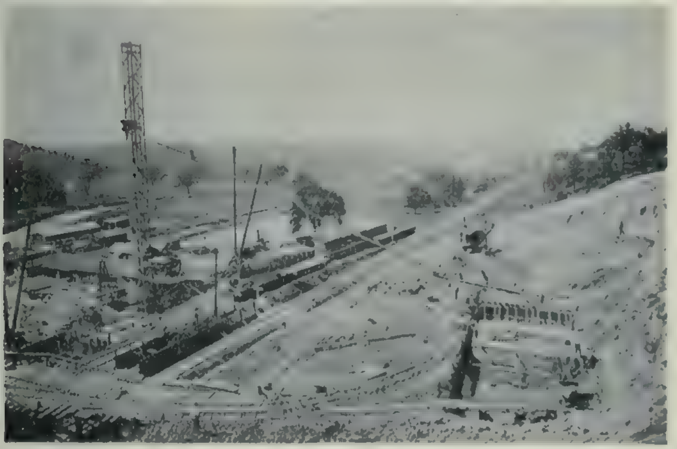


Fig. 11.—Pouring Pier A across C. P. R. tracks.

Piers H and I are carried below the surface of the rock three of four feet to a solid foundation, the surface of the rock not being sufficiently solid. These cuts are about 36 ft. below the surface of the roadway in the ravine. Pier J and all minor piers rest on spread footings on hard dry clay foundations.

The method of concreting in the Rosedale section is similar to that in the Don section. Two wooden towers, one on either bank, are used to elevate the concrete into steel hoppers, from which point it is distributed through steel chutes to the various piers and abutments. The materials for the Rosedale section had, of course, to be hauled, which constituted a considerable difficulty as compared with the Don section, where all material was distributed either by cable or dump cars.

The general contractors on the Rosedale section are the Dominion Bridge Company, Limited. The sub-contractors for the concrete work are the Raymond Construction Company.

Contracts for the mechanical trades for the Epworth Methodist Church, Toronto, and the Don Incinerator, Toronto, have been awarded to Keiths, Limited, 297 Campbell Avenue, Toronto.

Drain Cleaning Rods

The Rogers' Agencies, 84 Victoria Street, Toronto, are now manufacturing and selling in Canada the well known Malacca drain cleaning rods. Orders for these rods have just been placed by the Works Department of the city of Toronto and by the city of Saskatoon, Sask., the town of Brampton, Ont., and other places. These rods are used by plumbers, drain and electrical contractors and by cable, telephone, telegraph and railway companies. They save taking up floors, pipes, drains, etc., and can be used for cleaning out chimney flues, boiler tubes and other places where space is limited. These sectional Malacca drain cleaning rods are made of selected genuine Malacca cane. They are pliable and can be worked around L's, T's, Y's and other drain fittings. They can also be used to carry wires and cables underground through conduits.

Flexible rods, will work around corners.

Experiments with Gravel Roads in Iowa

(Concluded from page 1273)

grader until the road reaches that stage where the blade will not touch the surface. After that the plank or split log drag should be used. The drag will not shave the surface but will collect a little loose material as it moves along, and this will be sufficient to fill the small ruts and depressions that may have formed. It should be expected that during the first year the road will need constant attention. After that time it will need occasional maintenance so long as it will be used.

Many miles of gravel road have been inspected during the past season that were really dangerous for automobile travel because of the excessive cross slope. The gravel had been placed on an earth road surface which was itself crowned too highly. The gravel added another 8 or 10 ins. to the crown and no shoulders were brought up to the edge of the gravel. These roads were comfortable enough to travel so long as the car was straddling the crown of the road. But if compelled to turn off to the side it was not only uncomfortable to travel but positively dangerous when the earth side road was wet.

From the cost data obtained at Fort Dodge and on the part of the other experimental roads not yet completed, it is believed that serviceable double-track gravel road can be constructed for $2,500 per mile, where the haul for gravel does not exceed two miles and where gravel can be obtained at not to exceed fifty cents per yard.

Mrs. John Burrows, daughter of the late Major Georges Janin, chief civic engineer of Montreal, has received a letter from the Duke of Connaught expressing the sympathy of himself and the Duchess of Connaught on the loss of Major Janin.

In the Public Eye

A budget of comment presented in the interest of public welfare, independent of party politics and with malice toward no one.

The Liberal press is loudly demanding the resignation of J. R. Fallis, M.P.P. for Peel because he is alleged to have made an odd dollar in buying horses for the Government. As usual the astute Opposition organs have followed the Government to draw a red herring across the trail and are off in full hue and cry on the false scent. And while they are howling their lungs out over a spavined horse or two the Government has had the Shell Committee quietly and respectably buried and is leaving it to Messrs. Hichens and Brand to prove that the good committees do lives after them.

* * *

The tributes the English representatives pay to the late lamented are most touching. It "has met with remarkable success in dealing with a difficult task." "The measure of its success can be gauged by the remarkable results achieved." In fact it was such a remarkably able and conscientious organization that one wonders where those distinguished Englishmen ever found the heart to abolish it. But abolish it they did for even if some of its members find place on the Munitions Board the latter is a new and entirely different body. It is responsible to the Imperial authorities whereas the Shell Committee was responsible to the Dominion Government. To put it briefly the Dominion Government has buried its "war baby" and the fervent prayer it murmers over the grave is "May its sins die with it."

* * *

But the sins refuse to die. Manufacturers all over the country, both Conservative and Liberal, demand explanations. They want to know why certain firms could get contracts while others could not even get their names put on the list to be considered. They know that open tenders were not received till after those famous interviews which F. P. Jones so evasively denies. They want to know just what powers influenced that Committee in awarding tenders. They want to know if the Jones interview did not save the British taxpayers $21,000,000, just how much it did save him. In short they want that Shell Committee exhumed till a proper autopsy shows just why it died and like a hero of other wars was buried so darkly at dead of night.

* * *

And the manufacturers are entitled to this explanation. Many of them spent time and money trying to get contracts at a reasonable profit and could not even get consideration of their propositions. One man who had the factory and the men waiting for work went to Ottawa. Failing there he went to New York to see D. A. Thomas. Back from there he again went to Ottawa, hung up his coat and announced that he was going to stay till things happened. Did they happen? Not so that they were noticeable. Summoning all the influence at his command he finally succeeded in getting his name on the list of firms to be considered for contracts. Realizing that he had done his utmost he went home. Shortly afterward he learned that his name had been slipped off the bottom of the list. He had simply wasted his time and money. Is that man entitled to an explanation? He is. And his is not an isolated case.

The Shell Committee is dead, but the Government that created it still lives. That Government is responsible for its sins both of omission and commission. If that Government can show that the Shell Committee acted on its own initiative and betrayed the trust placed in it by its creators the latter are relieved of part of the responsibility. If the practical politicians of the Government are responsible for its peculiar methods of awarding contracts and they were placed where they would do the best good politically, the Government is the victim of its own machinery and must bear the full consequences.

* * *

But the public demand an investigation. They look not to the Conservative political machine but to Sir Robert Borden for that investigation. They feel that the Premier who is a gentleman rather than a politician, has been sinned against. They know that when next Sir Robert Borden visits England he will not want to be pointed out as the sponsor for a Committee that scattered its contracts like so much political graft, while our soldiers cried from the trenches for the munitions they so sorely needed. Sir Robert Borden may be deluded by the men he has trusted but he is not the man likely to stand idly by while the good name of the Dominion is dragged through the dirt and grime of a war scandal. Sir Robert Borden will act. Sir Robert Borden must act to save the reputation of the country he represents and his own political honor.

* * *

According to the Boston Transcript, Bridgeport, Conn., had only 5,000 employees in its factories when the war broke out. Nearly 40,000 operatives are now employed and in another month 20,000 more will be at work in new factories. The population has risen from 102,000 to 140,000 and would be more if homes could be found. The reason: Bridgeport has $175,000,000 in direct war orders besides $100,000,000 in other orders, many of which are war accessories. Has anybody heard of any Canadian city emulating the Connecticut town in orders or growth? Are Canadians asleep? Or did the dear departed Shell Committee shoo the orders across the line?

* * *

It begins to look as if the United States could not be much worse off if she were really at war with Germany. The hyphenated by-products of the Teutonic nations have violated her neutrality, blown up her factories and punched holes in her self-respect. The only recompense they can offer is the German vote. And who knows but by the time the presidential election is on it may be too much of a handicap for either party to carry.

* * *

When the Canadian Government commandeered 15,000,000 bushels of Canadian wheat it caused a sensation more than commensurate with the size of the undertaking. That amount of wheat is only about 5½ per cent. of the Canadian crop and the immediate effect of the coup was simply to entangle the wheat business for a few days so that dealers did not know where they were at. The move on the whole appears to have been political rather than business. It was meant as an answer to the "free wheat" cry in the west—a cry that needs no answer. But as usual, where politics and business are mixed, results were not as expected. It was found that the wheat commandeered was required by millers who had flour to make and dealers who had contracts to fill. To get the tangle straightened out the Government has been busy releasing the wheat to the dealers and millers. It is ever thus when politicians attempt plain everyday business. And yet we entrust the entire business of this trusting young country to the politicians. It is a habit.

France is enquiring, it is reported, in the United States for 2,000,000 nickel disks and is informed that she can secure them. Of course Canadian nickel will be used in their manufacture. Nothing strange about that. We're used to it. But the well-known United States writer Richard Harding Davis was candid enough the other day to tell his fellow countrymen that the French as a nation had a quiet contempt for people "too proud to fight." So figure it out for yourself: France buys from a people for whom she has contempt goods made from the raw material of a country whose sons helped keep the Huns out of Calais. Doesn't it appear to be about time the Government did something?

* * *

One V. Sly who dealt in war supplies without a license is now serving a four months' sentence in an English prison. Would it be infringing on the rights of the Munition Board to require Canadians who deal in war supplies to be licensed? In other words, shouldn't—well say a publisher require a license to handle a contract for shells?

* * *

To enact retroactive legislation so that the earlier contractors for munitions could be made to disgorge part of their profits is an excellent suggestion. But though it comes from a Government organ you can hardly hope that it will be acted upon. The days of the millenium are not yet with us. It is still as easy to extract profits from a profiteering contractor as it is for a camel to pass through the eye of a needle. Besides such a procedure might cripple the campaign fund and who can tell how soon the "barrel" may be needed.

* * *

The suggestion that Canada should give credit to the Empire comes from the London Times and should receive immediate consideration. The Thunderer calculates that in the present year Canada's exports will exceed imports by two hundred million dollars and points out that this balance will be at her disposal for any credits that may be arranged for supplies to Britain in lieu of cash payments. That the suggestion is timely everyone will admit. Canadians are of one mind in regard to the war. It is not Britain's war or Canada's war but a war that involves the freedom of the world. No sacrifice is too great to secure that freedom without which material prosperity would be merely an aggravation. Canada must do everything in her power to help bring the war to a successful close. Every bushel of grain, every dollar and every man capable of bearing arms must be at the Empire's disposal till freedom is assured, Belgium has been avenged and the German war machine is in the scrap heap. It is Canada's part not only to offer every assistance to the Motherland but to grasp every suggestion as to how that assistance may best be given. Giving Britain a line of credit will provide this young Dominion with a new sensation, or rather two sensations—pride in being classed among the creditor nations and pleasure that she is able to financially aid the Old Land in her hour of need. It is whispered that the Minister of Finance will insist on our banks loosening up.

* * *

With the Shell Committee buried and the Munition Committee responsible to the Imperial authorities the Government appears to have washed its hands of the entire war contract business. But does it owe nothing to the country it represents? There are idle factories in Canada that would be running full time if the Government were alive to its duties and capable of performing them. Take the city of Guelph for an example. It has factory accommodation to keep from 2,000 to 2,500 men working overtime on munitions. But though its manufacturers are alive to their opportunities all the war orders they have been able to land are a couple for shell plugs and one for shell boxes, the total amounting to about $75,000. Would a business Government see a neutral country flooded with war orders without putting forth some effort to secure part of this business for its own idle factories? Does its responsibility to the country cease when it shakes itself free from future charges of profiteering? Do our Cabinet ministers draw their salaries for the speeches they make at recruiting meetings?

* * *

And while changing committees is the order of the day why not apply it to the Purchasing Committee. It has a politician for a chairman and in these days when political influence is worked for everything from a contract to a commission the public feel safer with the politicians placed where they can do the least harm. Hon. A. E. Kemp is an estimable gentleman, a live manufacturer and a good citizen. But even he himself will admit the soft impeachment that he is a clever politician. It is time that the sign over the doors of all war supply committee rooms read "No Politicians Need Apply."

* * *

The busybodies who make other people's morals their chief concern have been at it again. The soldier who comes out of the trenches drenched and shivering can now get his jorum of rum only three times a week. Formerly he got it every morning. If I had my way every one of these "temperance" people would be sentenced to a month in the trenches—without rum.

* * *

Recruiting has now reached the stage where men must be asked to leave good positions to take their places in the ranks. It is a critical stage. When England reached it she made changes in her rules to make the ranks more attractive. Companies of chums were assured that they would be kept together after enlistment and other promises were given. A Canadian who is enjoying a fair salary hardly feels like taking the plunge until he is assured that he will not be asked to act as batman to some young officer who never earned $10 a week.

* * *

Henry Ford is only an ordinary every-day Yankee troubled with a rush of money to the head. Everybody is ready to help him spend his millions, but the Red Cross might have thought twice before accepting the $10,000 with which he tried to cover up his remarks anent the Anglo-French Loan Commission. This Empire is not so poor that she need accept money from her enemies whether they be Huns or humbugs.

* * *

The Financial Post is among those who think explanations re the abolition of the Shell Committee should be forthcoming. It says: "There is evidently something as yet to be explained. One commission succeeds another without the public being given what can be regarded as a satisfactory explanation. Documents such as that issued by Mr. Hichens, the British representative, intended obviously to allay the querulous, excite apprehension. There are, of course, some things that it is not wise to discuss publicly, but as to the supply of munitions, or such as comes within the sphere of the Shell Committee's work, frankness and publicity would appear to be better for the Government as well as for the nation. In the public mind there will undoubtedly remain the question, 'Why are all these changes necessary?' Are our Ministers and their staffs to be permitted to thus lightly hand over their responsibilities to commissions?"

SEARCHLIGHT.

Pro Patria

At the outbreak of hostilities Major Frank A. Creighton who had held a commission in the Corps of Guides offered his services and was attached to the First Ontario Battalion of which he has been second in command since Sept. Major Creighton has been a member of the Canadian Society of Civil Engineers for some years. In Ontario and the Maritime Provinces he has had a wide experience in railroad location and construction. From 1907 to 1913 he was successively city engineer and engineering commissioner of Prince Albert, Sask. When the La Colle Falls hydro-electric project was undertaken by the city he was appointed general manager for the city. He resigned from this position in the Fall of 1913 and established an office as consulting engineer in Winnipeg.

Major Frank A. Creighton

Personal

Mr. Narcisse Leblanc has been reinstated as Waterworks Engineer of Aylmer, Ont.

Mr. W. G. Worden, a graduate of the University of Toronto, has been appointed town engineer of Oshawa, Ont. Mr. Worden had previously been with the Department of Works, Toronto, for over six years.

Mr. F. J. Anderson, City Engineer of Niagara Falls, Ont., has asked to be released from his duties, as he had been put in charge of No. 2 Depot, 48th Battalion, C.E.F. He is to receive half pay during the time he is in Canada.

Mr. J. C. Breckon, late Water-works Engineer for the city of Vancouver, B. C., who has been engaged during the last few months in the Skeena River district, has returned to the city, and is now associated with the engineering firm of Messrs. DuCane, Dutcher & Co.

Mr. William McNab, principal assistant engineer of the Grand Trunk Railway, Montreal, has just retired from the board of direction of the American Railway Association, an organization with which he has been associated for sixteen years. His colleagues have made him an honorary member of the governing board and have also presented Mr. McNab with a splendidly bound autographed volume, in which there is inscribed an expression of the board's appreciation of the valuable services rendered by him in his various positions of trust and responsibility during his long term as director, vice-president and past president.

Mr. John Milne, the well-known iron and steel manufacturer of Hamilton, Ont., has received the high honour of an appointment to the Senate. Mr. Milne has been largely instrumental in developing the steel industry in Canada, and was one of the founders of the old Hamilton Steel and Iron Company, which has since developed into the Steel Company of Canada—one of the largest institutions of its kind in the country. Mr. Milne was born in Aberdeen, Scotland, in 1838, where he began to learn the trade of a molder. He came to Canada with his father in early life, and settled in Hamilton, where he worked as a molder in the foundaries of the Gurney Company. After completing his apprenticeship he worked in the States for a short time, but returned to Hamilton eventually, and with his friend the late Mr. Charles Stewart and the late Mr. William Burrow organized the firm of Burrow, Stewart & Milne. This business prospered and expanded, and has now reached large dimensions. He is identified also with several other important enterprises, and has large interests in the Canadian Steamship Lines.

Obituary

Mr. O. Bickford, a stone mason and a highly respected citizen of Cookshire, Que., died on November 6th, at the age of 74.

H. E. Burgess, the well-known Winnipeg contractor, died at the Winnipeg General Hospital following an operation. The late Mr. Burgess was 56 years of age. He went to Winnipeg from Woodstock, Ont, his native town, fifteen years ago, and was closely connected with the building and financial life of the city during the interval.

The death has occurred of Mr. David Williams, formerly divisional engineer on the Boston and Maine Railroad, and the St. Johnsbury and Lake Champlain Railroad, at St. Johnsbury, Vt. He was born at Holyhead, North Wales, on February 6, 1854. His parents moved to Canada in his early childhood and settled at Melbourne, Que. He received his education at the St. Francis College, Richmond, Que., and at the Quebec Military College. He was appointed 2nd lieutenant in the Canadian Militia.

The death occurred recently of Mr. John Ansley, of Wingham, Ont., at the age of 83. He was born near Kingston, Ont., but went to Wingham when quite young, and started the first iron foundry in that district. He also followed the business of a bridge-builder and contractor for a number of years. After his retirement from business he received the appointment of road and bridge commissioner for the county of Huron, which position he held for twenty-one years. The late Mr. Ansley was widely known and highly esteemed. He is survived by his widow, four sons, and a daughter.

The Canadian Locomotive Company, of Kingston, Ont., recently completed and shipped the first of the giant locomotives (E.351) which they are making for the Russian Railroad. It was packed in sixteen immense boxes, and occupied six full freight cars. The tremendous work involved in the mere loading of the various parts of the engine may be understood when it is stated that one of the crates alone weighed 65,000 lbs., while others weighed 25,000 or 30,000 lbs. each. Another locomotive (E.352) is practically completed, and others will follow.

Mainly Constructional

East and West—From Coast to Coast

Messrs. Eden Smith & Son, architects, Toronto, have moved to new quarters at 33 Scott Street.

The Dominion Sugar Company plan to erect a million dollar plant in Chatham, Ont.

The Provincial Stone and Supply Company, Limited, Toronto, has been incorporated.

The Montreal Quarry and Construction Supply Company, Montreal, have registered.

The Harris Heating and Engineering Company, Limited, Montreal, Que., have registered.

The completion of the asphalt paving for the year has given London, Ont., five additional miles of "good roads."

The new registry office building on May Street, Fort William, Ont., will be ready for occupancy in a few weeks.

In Welland, Ont., contracts have been awarded for a new printing house and for a suburban school to cost twenty thousand dollars.

Louis P. Barber, Montreal, Que., has registered, and will carry on business under the style of the L. P. Barber Hardware and Plumbing Company.

The plant of the Sillman Grain Bin Company, Medicine Hat, Alta., has been taken over by Mr. W. E. Clarke, who purposes manufacturing clay products.

Sam Kositsky and Abraham Costin have registered at Montreal, and will carry on business under the style of The National Scrap Iron & Metal Company.

Building in Toronto has had a decided spurt. Up to the 22nd of last month permits were issued for the construction of buildings valued at $532,307.

An unusual feature in connection with the building of the St. Paul Street viaduct at St. Catharines, Ont., is the fact that the cost was $13,000 below the amount estimated.

Building permits issued by the City Engineer of St. Catharines, Ont., for the month of November aggregated $45,996. Most of them were for workingmen's cottages, which are much needed there.

Mr. J. F. Whitson, Provincial Roads Commissioner of Ontario, says that he sees no reason why the good roads policy in Ontario should be interfered with because of the hard conditions brought about by the war.

The pressure filters which have been erected in connection with the Snowdy Springs water supply at Moose Jaw, Sask., have now been installed, and are being operated. The new filtration plant has a capacity of 50,000 gallons a day.

Messrs. McIlwee & Sons, tunnel borers, of Denver, have increased their claim for damages against Messrs. Foley Bros., Welch & Stewart over the boring of the pioneer and heading tunnels at Rogers Pass from $527,000 to $642,000.

The Provincial Stone and Supply Company, Limited, has been organized to carry on business at Toronto, with a capital of forty thousand dollars. The provisional directors are W. H. Irving, H. H. Davis, and J. S. Beatty, all of Toronto.

The Canadian Vincent Valve Company, Limited, has been incorporated with head office at Victoria, B. C., and a capital stock of twenty-five thousand dollars. The incorporators include A. Newham, R. H. Powell, and E. Bonner, all of Victoria.

Last week, the dipper dredge, Edmund Hall, No. 1, employed in dredging at the new wharf at Rocky Point, opposite Charlottetown, P. E. I., was destroyed by fire. The dredge was owned by Mr. V. T. Bartram, of Toronto, and cost about fifty thousand dollars.

The sum of $203,460 spent on building in Kingston, Ont., during the first eleven months of 1915 compares very favourably with the sum of $281,497 spent on building during the twelve months of last year. The building permits for November totalled $19,770, as against $4,829 for 1914.

The value of building construction work in Halifax, N. S., begun during November nearly doubled that undertaken during the same month in the year 1914, and the total for the eleven months of the year 1915 passed is over $100,000 ahead of the total for the same eleven months of 1914.

A company, known as the Peterborough Metal Products Company, has been formed, and will occupy the premises formerly owned by the Canadian Cordage Company at Peterborough, Ont. The company are installing machinery, and it is understood that they will commence the manufacture of metal products at an early date.

Woodstock, Ont., has a great deal of work on hand at the present time. The Woodstock Foundry Company have a full crew busily at work, while the Dunbar Engine and Foundry Company have orders for about $16,000 worth of work for the new mills of Price Brothers at Rimouski and for the Fraser Company at Nelson, N. B.

A structure typical of the excellent new modern school buildings which are springing up in different parts of the country and replacing the old unsanitary schools is the new school house on School Section No. 7, East Oakwood, Ont., which was formally opened recently. It is 34 by 50 feet in dimensions, of solid brick, with concrete basement.

There are three cities in Eastern Canada which show an increase in the value of building permits for the first ten months of the present year over those for the corresponding term of last year. These are: Sydney, N. S., with an increase of $73,949; Halifax, N. S., with an increase of $93,722; and Lachine, Que., with an increase of $254,562.

The City Architect of Toronto reports an increase in the number and value of building permits issued in November last over those for the corresponding month of last year. The permits for November, 1915, numbered 370, and their value was $799,395, as against 277 permits, of a value of $738,073 for November, 1914—an increase in values of $61,322.

Work has been commenced on preparing for the construction of Toronto's new Union Station, between Bay and York Streets. When completed this will be one of the finest railway stations for its size in America. It will have ten tracks and twenty ticket booths. Every convenience known to the modern builder will be provided, including an emergency hospital ward.

Eight lines of Hydro-Electric radials (two in Toronto), stretching for hundreds of miles in Ontario, and costing $13,734,155, with Toronto as the hub, was the ambitious programme laid before the Toronto Board of Control a short time ago, in the form of a by-law by the Ontario Hydro-Electric Commission. Toronto's share of this gigantic system will be less than one-third, or $4,240,196.

Mr. N. K. Laflamme, counsel for the defence in the Pelland case being heard at Montreal, asked a witness to define what "cemented boulders" were, this term having repeatedly been the subject of conjecture during the trial. Cemented boulders, said the witness, were small boulders bound together by a natural cement, which was as hard as stone. The term, he added, was one peculiar to the City Hall.

The first meeting of the local board of the Town Planning Commission of Yarmouth, N. S., was held on November 26th, in the council chamber. The speaker of the evening was Mr. Thomas Adams, Town Planning Adviser to the city of Ottawa, who addressed the meeting at some length on the objects of town planning commissions and the advantages to be gained by a city or town having such an organization.

Mr. William Dobson, of Indianapolis, Secretary of the Bricklayers,' Masons' and Plasterers' International Union of America, has been in Toronto to arrange for the biennial congress of the Union which will be held in Toronto next year for the twelve days following Monday, January 10. The most important question to be put before the congress is that of affiliation with the American Federation of Labour. The last time the congress met in Toronto was in 1891.

It is said the contractors for the Robert Simpson Company's new warehouse at Regina, Sask., will use approximately seven tons of putty before all the glazing has been completed. Practically half of the surface area of the building is glass. On account of the recent cold weather the roof has not been put on yet, but brickwork is being rushed as fast as the shortage of skilled bricklayers will permit. The glazing has been completed to the fourth floor.

The new reinforced concrete bridge at Saskatoon, Sask., which is now open to pedestrian traffic, is said to be the largest and most beautiful of the kind in Canada. It is 1,250 feet in length, and consists of ten concrete spans, the longest of which is 150 feet. The bridge cost $610,000, of which sum the city bears one-third, and the Government two-thirds. Details of the construction of this bridge have been given in earlier issues of the Contract Record.

In the County Council of York, Ontario, the committee to whom the question of extension of the good roads system was referred have reported in favour of connecting a road in South York with the improved highways in Simcoe County. The total mileage is about one hundred, and the estimated cost five thousand dollars for permanent bridges and culverts. The committee further reported that the location of roads to be improved be left to the municipalities in North York.

The jury investigating the cause of the tragedy at the University of Toronto last October, when a workman was killed by the collapse of a chimney on the new gymnasium building, gave a verdict of faulty construction and lack of good judgment on the part of the contractors in the construction of the supporting wall. They recommended that the City Council should apply to the Provincial Legislature to give the City Architect full power to order a change in the construction of any building to avoid accident and save human life.

A suit arising over the erection of the St. Stanislaus Catholic Church, Montreal, was given hearing on the 6th inst. before Mr. Justice Weir. E. N. Boileau & Co., the general contractors for the work, sue Damase Nault, who had the sub-contract for supplying the stone. It is alleged that Nault failed to perform his portion of the work, as a result of which the general contractors were put to much expense and inconvenience and had to secure the stone elsewhere. They claim $9,255—this being in part made up of a penalty of $25 per day for 310 days' failure to supply the stone. Nault denies all the allegations and says that if he was unable to supply the stone it was due to Boileau's fault or to other causes over which he had no control. The case is proceeding.

Judge Hayes has handed down his findings in connection with the Waterloo Avenue pavement at Guelph, Ont., which has been the subject of much controversy in civic circles. The Judge finds that there was nothing at all wrong with the manner in which the officials discharged their duties, that there was no graft on their part and that the work was well done. It is a complete vindication of ex-City Engineer Holland. It also clears Mr. Sam Carter, M.P.P., of the suspicion that was cast on him of using his position as Mayor at that time to give employment to men on the construction, on the understanding that they would vote for him in the Provincial contest. His Honor did not consider the evidence in that particular worth mentioning in his finding. The investigation will cost the city about $500.

The Pelton Water Wheel Company announce that Mr. Benjamin B. Lawrence, a member of the class of '78, Columbia School of Mines, has purchased the Pelton-Doble water wheel and the Pelton-Francis turbine exhibited by the manufacturers at the Panama Pacific International Exposition. Mr. Lawrence has presented these to his Alma Mater.

Trade Inquiry

Name and address of enquirer may be had on application to the Department of Trade & Commerce, Ottawa, Ont.

1218. **South African agency.**—A Cape Town agency firm is prepared to take up Canadian agencies for Western Cape Province in lumber, building material, hardware, tools, shovels, handles, asbestos, wire and nails.

New Books

American Sewerage Practice—by Leonard Metcalf and Harrison P. Eddy; McGraw-Hill Book Company, Inc., New York, publishers; price $6. This is Volume III of the series, the first two volumes treating, respectively, of the design and construction of sewers. The purpose of the present volume is two-fold: first, to explain in simple, non-technical language the nature of sewage and the changes that take place in it when it is subjected to varying conditions; and, second, to describe the structures designed to produce these various conditions, in order that the character of sewage may be changed to the desired extent before it finds its way into some body of water. The scope of the work is indicated fairly by the following chapter headings: I, Introduction: Progressive Steps in Sewage Treatment; II, Meaning of Chemical Analyses; III, Bacteria and Their Relation to the Problem of Sewage Disposal; IV, Plankton; V, Composition of Sewage; VI, Theories of Sewage Disposal and Treatment; VII, Sewage Disposal by Dilution; VIII, Grit Chambers; IX, Racks, Cages and Screens; X, Sedimentation, Straining and Aeration; XI, Tanks for Sludge Digestion; XII, Chemical Precipitation; XIII, Sludge; XIV, Contact Beds; XV, Trickling Filters; XVI, Intermittent Sand Filtration; XVII, Irrigation and the Agricultural Utilization of Sewage and Sludge; XVIII, Automatic Apparatus for Dosing; XIX, Disinfection of Sewage and Sewage Effluents; XX, Disposal of Residential and Institutional Sewage. 850 pages; well illustrated; size, approximately 6½ x 9 ins.

Extension to C.P.R. Hotel, Lake Louise

(Concluded from page 1269)

tion work was carried on at a very reasonable rate and at no excessive cost.

The entire design and construction of the buildings, including laundry and heating plant, were under the direction of Mr. Walter S. Painter, formerly architect for the Canadian Pacific Railway. Mr. Hayter Reed was manager for the hotel system. Preliminary construction was commenced by Mr. E. M. Read, now of Read, McDonald & Brewster, general contractors, Edmonton, and was completed by Mr. L. H. Painter. The author was designing engineer for the architect at Lake Louise during the winter of 1911-12.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Aylmer, Que.
The Board of Works are considering the installation of an electric pumping plant to replace the existing steam unit. Town Clerk, A. Malherbe.

Lanark County, Ont.
The County Council are considering the construction of a number of roads in Montague Township, at an approximate cost of $5,000. Clerk, W. A. Moore, Perth.

Leamington, Ont.
The Town Council are constructing sewers on Russell and Mill Streets and Victoria Avenue by day labor under supervision of the Works Commissioner.

Montreal, Que.
The Board of Control will receive tenders until December 18th for the supply and installation of one electrically driven pump, with a capacity of 6,000,000 gallons per day. Plans and specifications at office of the Engineer, W. T. Lesage, City Hall.

Ottawa, Ont.
The City Council have authorized the laying of wood block pavement on a portion of Rideau Street at an estimated cost of $19,900, and asphalt and wood block pavement to cost about $57,760. Engineer, F. C. Askwith.

The widening of Rosemont Avenue from Wellington Street to the south limit of Lot 32 has been authorized by the City Council. Approximate cost, $18,111.

Princeville, Que.
B. Feeney will commence the construction of a waterworks system in the spring. Work will include the erection of a pump station and installation of valves, pumps, hydrants and cast iron pipe. Estimated cost, $25,000. No tenders will be called.

CONTRACTS AWARDED

Brockville, Ont.
The contract for the installation of a filtration plant for the City Council has been let to the Roberts Filtration Company, Derby, Penn., at $86,000.

Toronto, Ont.
The Board of Control have let contracts for the construction of sewers on various streets to W. E. Taylor, 43 Clinton Street, Grant Contracting Company, 50 Front Street E., Moyes Construction Company, 592 Gerrard Street E., Longo & Gentile, 663 Markham St., Toms Contracting Company, 12 Rusholme Park Crescent, and Connolly Agnew Company, 606 Avenue Road, and the contract for the construction of West Toronto System, Outlet No. 2, to Jennings & Ross, 79 Spadina Avenue, at $22,000.

Railroads, Bridges and Wharves

Belleville, Ont.
The concrete work in connection with the O'Brien Bridge is being done by day labor.

Toronto, Ont.
A report on the construction of a Rapid Transit System has been presented to the Board of Control by E. L. Cousins of the Toronto Harbour Board, F. A. Gaby, Engineer to the Provincial Hydro Electric Commission, and Commissioner of Works R. C. Harris. Estimated cost, $18,000,000.

Wyton, Ont.
The W. Blow Sawmill Company propose to have a siding built into their premises from the Grand Trunk Railroad.

CONTRACTS AWARDED

Port Alberni, B. C.
Work is progressing on the construction of a wharf for the City Council. General contractor, R. H. Wood, Port Alberni.

Public Buildings, Churches and Schools

Brockville, Ont.
The General Hospital Board have taken over the New Athletic Grounds as a site for the proposed Old Folks' Home.

Galt, Ont.
A by-law to authorize the purchase of a site and the erection of an eight-roomed school in the North Side District will be submitted to the ratepayers on January 3rd. Approximate total cost, $50,000. City Clerk, J. McCartney.

Levis, Que.
The erection of a public hall is being considered by Caisse Populaire de Levis, 5 Begin Avenue. President and Manager, A. Desjardins. Estimated cost, $6,000.

McGregor, Ont.
The Roman Catholic Congregation are considering repairs to the foundations of the Church, installation of drainage and other improvements. Priest, Rev. J. A. Pinsonneault.

Montreal, Que.
Tenders on the installation of examing warehouse fittings will be received until 4 p.m., December 21st, by R. C. Desrochers, Department of Public Works, Ottawa. Plans and specifications at offices of A. H. Lapierre, Architect, 30 St. James Street, R. L. Deschamps, Overseer of Dominion Buildings, Post Office, Montreal, and at the Department. Specifications only with MacLean Daily Reports, Ltd., 25 Charlotte Street, Toronto.

Work has been started on the erection of a church on Rosemount Street for the Trustees of St. John Berchmans, 2619 Cartier Street. The contract for steel work has not yet been awarded. Remainder of work will be done by the general contractor.

St. Catharines, Ont.
The School Board of School Section No. 6, Grantham, will purchase a number of seats and a quantity of furniture early in the New Year. Secretary, R. T. Miller.

Stratford, Ont.
Plans are being prepared for a parochial hall to be erected for the Congregation of St. Joseph's Roman Catholic Church. Work is expected to start early in the spring. Priest, Very Rev. Dean McGee.

Westport, Ont.
Tenders on the erection of a Presbytery for St. Edwards Church are being received by the Secretary, J. F. McNally. Plans and specifications with the Secretary.

CONTRACTS AWARDED

Brantford, Ont.
The City Council have let the following contracts for interior alterations to the General Hospital St. Paul Street and Terrace Hill:—general contract, Schultz Bros. Company, Ltd., 35 Albion Street; marble work, Italian Mosaic & Tile Company, Ltd., Manning Chambers, Toronto; heating and plumbing, Anguish & Whitefield, 40 Colborne St.; electrical work, Lyons Electric Company, 71 Colborne Street. Approximate cost, $5,000.

Halifax, N. S.
The following contracts have been let in connection with the church which is being built at Windsor and Almond Streets for the Evangelical Lutheran Congregation;—plastering, A. Hutchinson, 250 Ochterloney Street, Dartmouth; painting, Walsh Bros., Ltd., 230 Hollis Street; plumbing, G. H. Kinsman, 72 Cornwallis Street; electrical work, Farquhar Bros., Barrington Street; interior fittings, A. A. McDonald, Cooks Wharf.

Peace River Crossing, Alta.
The contract for the erection of a schiol has been let by the School Board to the Peace River Construction Company, Peace River Crossing. Contractors are in the market for lumber, cement, etc. Approximate cost, $7,500.

Saltfleet Township, Ont.
The erection of a school at Burlington Beach is being considered by the Township of Saltfleet and Burlington Beach. Clerk, Erland Lee, Stoney Creek.

Welland, Ont.
The contract for the installation of interior fittings at the office of the Water Commissioners has been let by the Town Council to the Globe Furniture Company, Shantz Avenue, Waterloo, Ont.

Business Buildings and Industrial Plants

Arnprior, Ont.
The Arnprior Agricultural Society contemplate the erection of a building at the Agricultural Grounds. Tenders will probably be called for at an early date. Architect, J. P. MacLaren, 104 Sparks Street, Ottawa.

Balaclava, Ont.
Harry Richards, Dacre Post Office, Ont., is preparing to rebuild his sawmill, which was recently destroyed by fire.

Beauceville, Que.
Gagne & Rodrique have necided to rebuild their stores. Work will start in the spring. Frame and brick construction.

Fergus, Ont.
A by-law to loan the Superior Barn Equipment Company $10,000 for the establishment of a factory will be submitted to the ratepayers by the Town Council. If the by-law is passed the company will spend $7,500 on remodelling a building which they have purchased. Town Clerk, J. Beattie.

Hamilton, Ont.
The City Council are erecting camp buildings on King Street E., estimated to cost $15,000. Engineer, F. Wardrope, City Hall.

Hensall, Ont.
D. A. Cantelon is considering the erection of sheds for storage of coal. Approximate cost, $3,000.

Kincardine, Ont.
A by-law to grant tax exemption for a period of ten years to the Ontario People's Salt & Soda Company, Ltd., will be submitted at the January elections. If this is passed the company will make additions to their plant, estimated to cost $10,000. Manager, John Tolmie.

Listowel, Ont.
A by-law will be submitted to the ratepayers on January 3rd to authorize the loan of $12,000 to a company for the erection of a boot and shoe factory. Company consists of H. B. Morphy, F. W. Hay, A. H. Hawkins and J. S. McGee, all of Listowel.

London, Ont.
Plans have been prepared for storehouses to be erected by Copp Bros., York Street. Steel construction, concrete foundation, corrugated iron roofing. Approximate cost, $3,500. Work will start shortly.

The City Council are considering the establishment of a live stock market, and will submit the matter to the ratepayers on January 3rd. Estimated cost, $7,000.

Work will start shortly on the construction of soldiers' quarters under the Grand Stand at the Fair Grounds. Material will be purchased and work supervised by Major Bishop, Headquarters Staff, Welesley Barracks, London.

Miniota, Man.
The following parties have decided to rebuild their premises destroyed in the recent fire:—J. D. Forsyth, store, brick veneer construction, approximate cost, $4,000; C. Watts, theatre and stores, brick veneer construction, $5,000.

Montreal, Que.
Clovis Morin, 2572 Christophe Colomb Street, has commenced the erection of a store and residence, estimated to cost $3,000. Brick construction, concrete foundation, felt and gravel roofing. Work by day labor.

All work required in connection with the warehouses in course of erection for the H. B. Smith Estate, 266 Mullins Street, will be done by the general contractor, A. Chenevert, 108 Delorimier Avenue.

Ottawa, Ont.
E. W. Marshall, 360 St. Catherine Street, is about to erect a stable and garage on Bay Street at an approximate cost of $3,000. Ironclad construction, concrete foundation, corrugated iron roofing.

Port Stanley, Ont.
The London & Port Stanley Railway Board are considering the erection of four comfort stations. Work may not start until spring. Secretary, William Spittal.

Prescott, Ont.
The Newell Manufacturing Company, Patterson Street, Ogdensburg, N. Y., have acquired a stone building, which they propose to remodel. Work will include the installation of a complete heating plant and an electric elevator. The company also desire to receive prices on two large steel sash with all necessary fittings.

Quebec, Que.
Plans have been prepared for the conversion of premises at Third Avenue and Sixth Street, Limoilou, into a bank for the Hochelaga Bank, Montreal. Work will include the installation of heating and electrical systems. Estimated cost, $3,000.

Renfrew, Ont.
No sub-contracts will be let in connection with the works which are being built for the Energite Explosives Company, Ltd., Power Building, 83 Craig Street W., Montreal.

St. John's Nfld.
Plans have been drawn for a business building to be erected for W. F. Kenny, New Gower Street.

Toronto, Ont.
T. R. Haig, 14 Shaftesbury Avenue, has started work on alterations to a store at 1224 Yonge Street. Work consists of a new store front and interior alterations.

Work has been started by T. Robinson, 131 Glenholme Avenue, on the erection of a pair of stores at 754 St. Clair Avenue W. Brick construction, felt and gravel roofing. Approximate cost, $7,500. Smaller trades will be let.

Welland, Ont.
The Canadian Steel Foundries are building an addition to their plant. All work is being done by the company. Steel construction.

Westport, Ont.
T. G. Butler has commenced the erection of a store and residence, estimated to cost $4,000. Brick veneer construction, galvanized iron roofing.

CONTRACTS AWARDED

Berlin, Ont.
In connection with the factory in course of erection at Edward and Breithaupt Streets for Armstrong & Inrig, the contract for plumbing and heating has been let to William Knell & Company, King Street E.

Brantford, Ont.
The contract for painting in connection with the erection of a street railway station on Market Square for the City Council has been let to R. C. Chave, 17 Pearl Street.

Hamilton, Ont.
The contract for roofing in connection with the alterations which are being carried out at the factory of the Steel Company of Canada on Sherman Avenue N., has been let to Thomas Irwin & Son, 22 McNab Street. Masonry, painting, heating, plumbing, electrical work and interior fittings will be done by owners.

Montreal, Que.
Work has been started on the erection of a factory for the Steel Company of Canada, 1272 notre Dame Street W. The general contract has been let to G. M. Cape Company, 920 New Birks Building, the steel work to Structural Steel Company of Canada, Ltd., New Birks Building, and the contract for metal sash to Steel & Radiation Ltd., 304 University Street. Approximate cost, $24,000.

Work has been started on alterations to the premises at 1467 Garnier Street for Mrs. L. Glass. The general contract has been awarded to N. Allouf, 1207 Cadieux Street. Estimated cost, $5,000.

Niagara-on-the-Lake, Ont.
Holohan & Bissell have commenced the erection of a business block on Queen Street for Thomas Hart. The heating, plumbing and lighting work will be done under supervision of James Laughton.

Ottawa, Ont.
R. Cohen, 25 Russell Avenue, has let the general contract for the erection of a store and residence to Kestesel Cohen, 25 Russell Avenue. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $8,000. Work has been started.

Quebec, Que.
Work has been started on the erection of a transformer station for the Public Service Corporation, 53 Crown Street. The contract for foundations has been awarded to the Sharp Construction Company, Bickellis Bridge. Remainder of work will be done by owners. Brick construction, concrete foundation. Estimated cost, $3,000.

The contract for roofing in connection with the warehouse which is being erected by C. E. Morissette Ltd., 208 Latourelle Street, ras been let to E. Faladeau, 142 Dorchester Street. Subcontracts will be let for electrical work, heating and plumbing.

Sydney, N. S.
Work has been started by S. H. Stevenson, 90 Charlotte Street. The contract for roofing has been let to Shaw & Mason, Ltd., 204 George Street. Estimated cost, $5,000.

Toronto, Ont.
In connection with the erection of an office building at Church and Court Streets for the Imperial Oil Company, 311 Dominion Bank Building, the contract for masonry, cut stone, concrete and fireproofing has been awarded to Witchall & Sons, 156 St. Helens Avenue, and the steel work to the Dominion Bridge Company, 20 Victoria Street.

The general contract for the erection of a factory at Davenport Road and Lightbourne Street for the McCallum

Company, 44 Dupont Street, has been awarded to A. J. Peppiatt, 12 Wells Hill Avenue. Brick construction, felt and gravel roofing. Approximate cost, $7,500. Contract does not include heating.

The Royal Bank of Canada have let the general contract for the erection of an addition to their premises at Danforth Avenue and Dawes Road to Purdy & Henderson, 10 Cathcart Street, Montreal, Que. Estimated cost, $15,000.

Victoria, B. C.

The general contract for the construction of buildings for the Imperial Oil Company, Ltd., 404 Abbott Street, has been let to the Dominion Construction Company, 509 Richards Street. Works consist of a concrete warehouse, brick stable and frame office building.

Welland, Ont.

. The Standard Steel Construction Company are building an addition to the plant of the Canada Forge Company. Approximate cost, $25,000.

Windsor, Ont.

Work has been started on alterations to the Dougal Block for Simon Meretsky, Mercer Street. The contract for roofing, sheet metal work and plumbing has been awarded to Pennington & Brian, 47 Sandwich Street W., and the heating to the Windsor Hardware Company, 71 Sandwich Street E.

Winnipeg, Man.

The contract for painting required at the factory which has been built on Portage Avenue for the Ford Motor Company, Fort City, Ont., has been awarded to the general contractors, Carter-Hall-Aldinger Company, Union Bank Building.

Residences

Colchester South Township, Ont.

The erection of a residence is being considered by Charles Hyder, c/o Roland Holstead, Footes Corners, Harrow. Estimated cost, $3,000.

Dundas, Ont.

W. W. Boult, King Street, has commenced the erection of a residence on Sydenham Street, estimated to cost $3,500. Brick construction, concrete foundation, shingle roofing.

Exeter, Ont.

Wesley Snell will build a residence in the spring. Estimated cost, $3,500.

Ilderton, Ont.

Work has been started by James R. McIntosh on the erection of a residence. White brick construction, concrete foundation, shingle roofing. Approximate cost, $3,000.

London, Ont.

James Neilson, c/o Dyment Baker Lumber Company, has commenced the erection of four residences on Waterloo Street. Frame construction, concrete foundation, shingle roofing. Estimated cost, $4,000.

Montreal, Que.

Owen Roberts, 112 Addington Avenue, has commenced the erection of two flats, estimated to cost $10,000. Brick construction, concrete foundation, felt and gravel roofing. Work by day labor.

J. E. Globensky, 508 Oxford Avenue, is building a cottage on Mayfair Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,000.

Work has been started by John Dominique, 166 Marcil Avenue, on the erection of two residences on Marcil Avenue. Brick construction, concrete foundation, felt and gravel roofing. Approximate cost, $14,000.

G. E. Blackwell, 4184 St. Catherine St., Westmount, is receiving tenders on roofing and tiling required at the flats which he is building at 115 Marlowe Street.

Beaudry Leman, 148 St. Hubert Street, has had plans prepared for alterations to his apartment. Work by day labor. Estimated cost, $3,500. Architect, W. E. Doran, 189 Bleury Street.

Olinda, Ont.

William Ryall, c/o T. D. McDonald, is considering the erection of a residence at an approximate cost of $3,500.

Ottawa, Ont.

A. E. Toms, 155 Sunnyside Avenue, is receiving tenders on plastering, heating, plumbing and electrical work required in connection with the residence which he is building on Glen Avenue. Painting by day labor.

Outremont, Que.

No tenders will be called in connection with the cottages which are being erected by Pierre Guidazio, 615 Bloomfield Avenue.

Quebec, Que.

Work is progressing on the residence which is being built by Lavoie, Martel & Beaupre, c/o Esdras Lavoie, Charlesbourg Road. Brick construction, concrete foundation, metal and asbestos roofing. Estimated cost, $5,000.

St. John's, Nfld.

Plans have been prepared for a tenement building to be erected for J. Davey, Bond Street.

Toronto, Ont.

A. Beckett, Nairn and Morrison Sts., has commenced the erection of a residence estimated to cost $3,000. Smaller trades will be let. Brick construction, shingle roofing.

Work has been started by J. H. Larkin, 6 Ravensden Street, on the erection of a pair of residences at McKay and Elmwood Streets. Brick construction, shingle roofing. Estimated cost, $4,500. Smaller trades will be let.

Cox & Cummings, 36 Canada Life Building, are erecting a residence on Pine Crescent Street, estimated to cost $4,000. Smaller trades will be let. Brick construction, shingle roofing.

W. J. McWaters, 28 Kingswood Road, has commenced the erection of a residence at 92 Neville Park Boulevard, estimated to cost $3,000. Brick construction, shingle roofing.

H. A. Johnston, 63 Normandy Boulevard, is building a residence, estimated to cost $3,000. Brick construction, shingle roofing. Contracts have been let for all the smaller trades.

Windsor, Ont.

Walter J. Hales, 53 Gladstone Avenue, has commenced the erection of a residence on Moy Street, stimated to cost $3,500. Bricn construction, concrete foundation, shingle roofing. Owner will do all work.

Work has been started by Peter Osterhout, 23 Pitt Street E., on the erection of three residences on Clinton St. Frame construction, concrete foundation, shingle roofing. Approximate cost, $3,000 each.

J. W. Aubin, Dime Bank Building, Detroit, Mich., has decided not to erect a residence here, but will build in Detroit.

All work required in the erection of four flats on Howard Street for David Meretsky, 120 Aylmer Avenue, will be done by day labor. Architect, G. Jacques & Company, Boug Building.

Winter & Little, Pitt Street W., have commenced the erection of seven residences on McKay and Pelessin Streets, estimated to cost between $3,000 and $4,000 each. Frame and brick construction, concrete foundation, shingle roofing.

CONTRACTS AWARDED

Britannia, Ont .

Work is progressing on the residence which is being built by L. C. Smith, Highland Park, Westboro. The contract for electrical work has been let to J. E. W. Lewis, Westboro. Brick veneer construction, stone foundation, shingle roofing. Approximate cost, $3,000.

Halifax, N. S.

In connection with the flats which have been erected on Robie Street for W. G. Kennedy, Marlborough Woods, the plumbing contract has been awarded to W. S. Craig, 316 Upper Water Street, and the electrical work to J. T. Dorey, 65 Granville Street. Plastering will be done by the general contractors, City Building & Land Company, 164 Hollis Street.

The contract for plumbing in connection with the residences which are being built on Cedar Street by the City Building & Land Company, 164 Hollis Street, has been awarded to W. S. Craig, 316 Upper Water Street.

James McNaught, 477 Wilson Street, has let the following contracts in connection with the residences which he is building on Somerset Avenue:—plastering, C. Howard, 174 Belview Street; painting, W. Gibson, 173 Rosslyn Ave.; heating, McLary Manufacturing Company, York Street; plumbing, J. H. Kerr, 32 Sherman Street N.; electrical work, F. Thornton, 174 Balmoral Street.

Hamilton, Ont.

In connection with the residence which is being built by Sparks & McKay, 9 Fairhold Avenue S., the contract for heating has been let to McClary Manufacturing Company, York Street, and the plumbing to J. Gibson, 676 King Street E.

Maisonneuve, Que.

The electrical work required at the residence which has been erected for Mrs. M. G. Egrement, 529 Lafontaine Street, will be done by the general contractors, Guertin & Bouchard, 410 Parthenais Street.

Montreal, Que.

Work has been started by Kensington Building & Construction, 296 Madison Avenue, on the erection of two flats on Grand Boulevard for G. N. W. Zwinge, 296 Madison Avenue. Tenders are now being received for mill work, roofing, painting, heating, plumbing and electrical work. Approximate cost, $8,000.

Hand & Pick, 609 Belmont Street, Westmount, have commenced the erection of four flats on Wilson Street for J. H. Hand, 609 Belmont Street, Westmount. No sub-contracts will be let. Brick construction, concrete foundation.

felt and gravel roofing. Approximate cost, $14,000.

Montreal West, Que.
The following contracts have been let in connection with the residence which is being built on Brock Avenue W. by Reid, McGregor & Reid, 513 Drummond Building, Montreal:—roofing, Richardson, Simard & Company, 745 Clarke St.; painting and glazing, G. E. Blackwell, 4184 St. Catherine Street, Westmount; heating and plumbing, T. L. Bain, 31 Westminster Avenue; electrical work, E. Gregory, 1594 Cadieux Street.

Ottawa, Ont.
William O'Connor, 495 Somerset, has commenced the erection of a residence, estimated to cost $5,000. The masonry has been let to Beattie & Davidson, Renfrew Avenue, and the plastering to Charles Patterson, 873 Somerset Street. Other trades not yet awarded. Brick veneer construction, stone foundation, shingle roofing.

In connection with the residence which is being built on Brighton Street by A. E. Toms, 155 Sunnyside Avenue, the contract for plastering has been let to T. Jarvis, 18 Fourth Avenue, the heating to the Capital Hardware Company, Bank Street, the plumbing to H. E. Knox, Elgin Street, and electrical work to T. E. Hopson, 134 Bank Street.

Walter Fryer, 5 Glen Avenue, has let the contract for heating and plumbing in connection with the residence which he is building on Roslyn Street to Gervin & Lillico, Bank and Sunnyside Streets.

In connection with the residence being built on Grove Street by G. E. McMenemy, 40 Roslyn Avenue, the contract for masonry and brick work has been let to Beattie & Davidson, Renfrew Avenue. Tenders are now being received for plastering, painting, heating, plumbing and electrical work.

Outremont, Que.
Work has been started by C. Gourrie & Company, 1169a St. Andre Street, on the erection of two residences on Rockland Avenue. The plastering contract has been let to A. Murray, 2404 Boyer Street, Montreal, the roofing, heating and plumbing to J. E. Lalonde, 427 Church Street, Verdun, and the electrical work to G. Martel, 229 Bernard Street, Montreal. Masonry and carpentry by owners.

Quebec, Que.
In connection with the residence in course of erection for J. Gingras, 203 St. Olivier Street, the contract for roofing and heating has been let to P. Paradis, 236 D'Aguillon Street, and the electrical work to A. Pelletier, 246 St. John Street. Painting by the general contractor, A. Darveau, 152 Latourelle St.

The contract for masonry and plastering in connection with the residences which are being erected for E. J. Payette, 831 St. Valier Street, has been awarded to A. Latulippe, 118 Bagot St., the roofing, plumbing and electrical work to L. Lajeunesse, 78 St. Agnes Street, and the painting to Charles Roussel, 58 Ste. Ambroise Street. Carpentry by the general contractors, D. Maranda & Frere, 812½ St. Valier St.

Walkerville, Ont.
The contract for heating and plumbing at the residence in course of erection on Windermere Avenue for C. M. Bennett, 22 Assumption Street, Windsor, has been let to R. Hicks, 99 Langlois Street, Windsor. Painting, glazing and electrical work by owner.

Power Plants, Electricity and Telephones

Aylmer, Que.
The Board of Works are considering the construction of extensions to the lighting system. Town Clerk, A. Malherbe.

Port Elgin, Ont.
The Village Council will submit a by-law to authorize the installation of a hydro-electric system. Clerk, D. Geddes.

Sarnia, Ont.
The City Council will submit a by-law on January 3rd to provide for the purchase and remodelling of the generating plant and distribution system of the Sarnia Gas & Electric Light Company. Approximate cost, $120,000.

Warwick, Que.
The Town Council are considering the construction of a light and power system at an approximate cost of $10,000, and are negotiating with the Arthabasca Water & Power Company for a supply of power. Secretary to the Town Council, E. Laliberte.

Fires

Belleville, Ont.
Fire has done considerable damage to the interior of the Armory on Church Street.

Faraday, Ont.
The residence of T. Neil has been totally destroyed by fire.

Fort Erie, Ont.
The residence at Garrison Road and Goderich Street, owned by Mrs. Mary Koletschke has been destroyed by fire. Loss, about $5,000.

Leonardville, N. B.
The store and factory on Deer Island, owned by the Leonardville Trading Company, have been completely destroyed by fire. Loss, $10,000, partially insured.

Liverpool, N. S.
The store of F. L. Seldon & Sons, Main Street, has been entirely destroyed by fire. Loss to building and stock, $9,000.

Oakville, Ont.
The woodworking factory owned by W. H. Carson has been damaged by fire to the extent of about $5,000. Repairs will be made immediately.

Quebec, Que.
Fire has damaged the plant of the Eastern Canada Steel Company to the extent of about $10,000. Manager, L. H. Gaudry.

Sackville, N. B.
Part of the factory of A. E. Wry Standard Ltd., Lorne Street, has been destroyed by fire. Loss on building and stock, about $35,000, partially insured.

St. Catharines, Ont.
Fire has entirely destroyed a boarding house owned by G. Bohagian, 3 Carleton Street. Loss, $3,000.

Fire has destroyed the flour mills of the Maple Leaf Milling Company. Loss, between $75,000 and $80,000.

Miscellaneous

Chatham, Ont.
The City Council will submit a by-law on January 3rd to sanction the expenditure of $15,000 on the purchase of fire-fighting equipment. Clerk, W. G. Merritt.

Cottam, Ont.
W. J. Wyatt is in the market for about thirty tons of crushed stone or sand per month.

Moncton, N. B.
E. J. Thomson, Box 84, will shortly be in the market for a supply of cement, fireproofing, concrete mixers, safes, plate glass, reinforcing bars, water tower, wood paint.

Montreal, Que.
The City Council have had plans prepared for three comfort stations, to be erected on Chaboillez Square, Place d'Armes and Dominion Square. Approximate cost, $5,000, $8,000 and $10,000 respectively. Architect, A. Chausse, City Hall.

Ottawa, Ont.
Prices and other information with regard to the following materials are being received by E. Williams, 172 Glenora Avenue:—steam boilers, hot water boilers, plumbing fixtures, electric pumps, steel tanks.

Port Arthur, Ont.
The Western Machinery Company, Lincoln Street, are about to move into larger premises on North Court Street, and propose to instal a quantity of new machinery.

Thorold, Ont.
Edward Small is receiving prices, catalogues and other information with regard to small rearth tile, enamel brick, coal and wood grates for fireplaces .

Toronto, Ont.
The Board of Control will receive tenders until December 21st for the supply of fire hose, motor, fire apparatus and gasoline tanks. Specifications at office of the Fire Department, 152 Adelaide Street W.

Winnipeg, Man.
A report has been submitted to the City Council by Engineer W. P. Brereton, 223 James Avenue, in which he estimates the cost of connecting the electric lines with the gas engines at the High Pressure plant to be $10,000 if the lines are carried on poles, and $35,000 if they are placed in underground conduits.

S. H. Reynolds, Chairman of the Commissioners of Greater Winnipeg Water District, 901 Boyd Building, will receive tenders until noon, December 27th, on the supply of one saddle tank locomotive. Specifications at office of the District.

CONTRACTS AWARDED

Toronto, Ont.
The Board of Control have let the contract for smoke breeching at the Main Pumping Works to the Thor Iron Works, foot of Bathurst Street, at $1,849.

The contract for track scales at the Main Pumping Station has been awarded by the Board of Control to the Canadian Fairbanks Morse Company, Ltd., Front Street W., at $2,600.

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Conservation in the Contracting Field

IN these days of keen competition greater efficiency appears to be the only certain key to success. Conservation of our energy and our time are as necessary as conservation of any of our other resources. Whatever is spent in time, money, energy or material over and above what would, under better conditions, accomplish the same result, is defeating the purpose of this modern campaign for conservation of our national resources. In the end every individual citizen has to bear his share of the added burden.

We have spoken in earlier issues of the Contract Record of the tremendous loss of time when a number of contractors figure on any given piece of work. It is useless to argue that this is the contractor's own business, and that, therefore, he it is who bears the expense. This argument misses the main point. If any contractor spends an extra ten hours estimating a job he is bound to add so much more to his bid. If he fails to get the first contract, it is added, with compound interest, to the second bid—and so on, accumulating indefinitely. Suppose twenty contractors bid on a job—which only one can get—the remaining nineteen men compensate themselves on future orders. By the time the twentieth man gets his contract he has a big accumulation of "overhead," which he must either make up on his first accepted bid, or—he goes out of business. Right here is a very considerable factor in the ever-increasing cost of construction work—a condition practically beyond the control of the average contractor, we admit, and entirely so of the man doing business on a moderate scale. The correction of this evil appears to lie rather with the authorities for whom the building is being constructed.

* * *

If it could only be brought home to municipalities, school boards, and such authorities, that the added expense incurred by twenty contractors estimating on their work was not borne by the contractors themselves, but was added to the cost of the building, something might speedily be accomplished. However, these matters are generally left to the architect, and apparently it is to this individual that we must look for redress. And here, probably, we get at the root of the whole trouble. One of the difficulties in estimating on the average piece of work is that the specifications are not sufficiently complete and definite, and we too often see an advertisement for contractors to figure on their own specifications. What municipality would think of employing twenty architects to draw as many plans? And yet these same municipalities are practically employing twenty contractors to do this same architect's work, and they may rest assured that the contractors will charge up the cost of this work. Otherwise the contractor could not exist. His living depends on being paid for his work, and if one municipality does not pay it another must.

* * *

The solution apparently lies, then, in either extending the scope of the architect's work or in the creation of another step in the process of building. In England, for example, instead of requiring the twenty different contractors each to figure on the quantity of his material, they have what is known as a quantity surveyor or estimator. Such a person is practically unknown in Canada, and very little known in the United States. The possibilities for expert estimators on this continent, therefore, appear to be very large.

The employment of one man to estimate the quantities of the various materials required in any building evidently reduces the work of each estimating contractor just this much. This is then a form of conservation of the very first importance. Supplied with absolutely definite specifications and definite fixed quantities on which to figure, the work of every contractor is simplified and his costs correspondingly reduced. Further, the troubles arising from errors which many a contractor makes in taking off his quantities would be eliminated. Would this not mean a greatly improved state of affairs in the building trade, and ought we not to be working in that direction?

Sir Adam Asks Us to Act First and Think Afterwards

(1) Sir Adam Beck has just presented his radial scheme to the Board of Control and asks that a by-law be submitted to the citizens of Toronto guaranteeing the bonds of this road to the extent of $4,200,000. This is just about one-third of the total cost of the whole line from Toronto to London. The magnitude of this sum is explained, however, as including complete terminal facilities in the city of Toronto.

(2) A report has just been made to the City Transportation Committee by Messrs. Harris, Cousins and Gaby covering the question of a semi-rapid transit entrance into the city with complete terminal facilities. This report costs the city $50,000 and, judged by the personnel of the Committee, is worth that sum.

It will thus be noted that the citizens of Toronto have at the present moment two transportation schemes before them covering practically the same ground. As we see it, therefore, the adoption of either means the rejection of the other. This necessarily presupposes a study of both and a careful comparison of their relative merits and advantages.

But both of these schemes are absolutely new to the citizens of Toronto. One involves an expenditure of over four million dollars, the second over eighteen millions. If either of these propositions comes before the electors it means that they must, during the next ten days, make themselves sufficiently conversant with a twenty-two-million-dollar expenditure to vote intelligently for or against.

* * *

Yet in spite of these self-evident facts a snap vote is to be taken on the Hydro scheme. By this action the larger transportation report (which cost $50,000) is automatically shelved, since, if the Beck by-law carries, the report is practically useless—unless, of course, Toronto wants two terminals at the same point.

This article must not be construed as an argument against the Beck by-law. It may be the best by-law that was ever submitted to the citizens of Toronto. We can't say, because we haven't had a chance yet to study and compare the two schemes side by side. We have spoken, too, to several engineers and business men who are interesting themselves in the matter, and they all express the same opinion—Why such haste? Why not give us a chance to size up the good points of this Hydro scheme and compare them with the report? This can not be done by January 1. It is a matter that might well take three months, or six months, or even a year. If the city council and the Mayor of Toronto insist on rushing this by-law on they will be laying themselves open to a charge either of poor judgment or of party trickery.

What are the arguments in favor of such haste? Workmen and money are both scarce, and at best needed more urgently at the moment for other purposes. Sir Adam, too, has frequently stated that these radials will not be proceeded with until the governments have committed themselves on the subsidy question—and the governments haven't yet committed themselves.

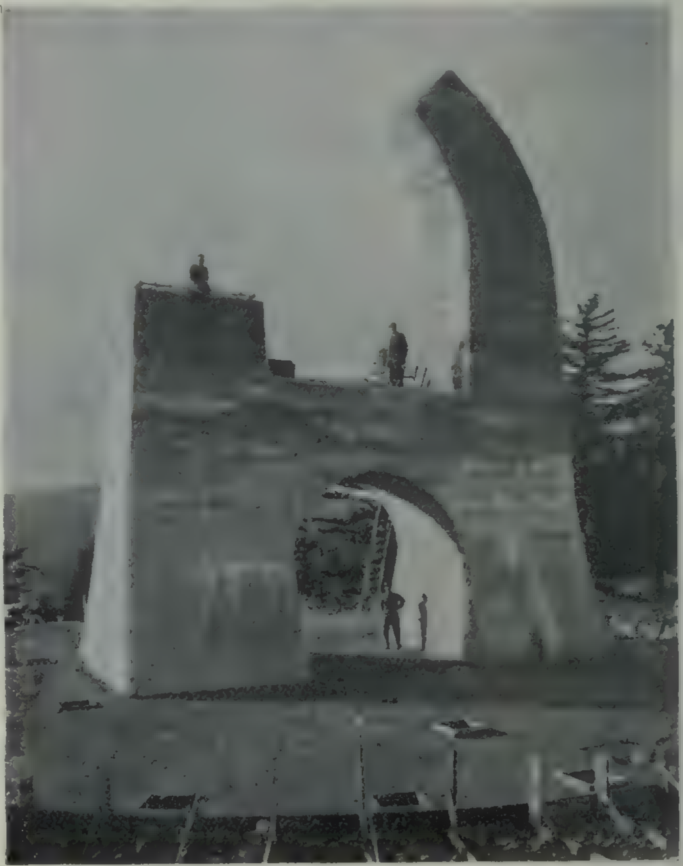
* * *

We urge strongly that this by-law be withdrawn until such time as the citizens have had a chance to study it side by side with the semi-rapid transit report—compare them, and determine whether possibly they might not be worked in together. If this cannot now be done, the ratepayers will be justified in voting it down.

Every argument is against a vote being taken on January 1 on either of these plans. An honest council will not ask the citizens to commit the folly of voting four million dollars on a proposition they know absolutely nothing about. The citizens are in no way fitted to vote on such a big proposition without more mature consideration.

The Little Saanich "Piers"

The illustration herewith represents what is now known in the city of Victoria as the "Piers." It is the foundation structure for the large telescope being erected on Little Saanich Mountain. By comparison with the figures of the workmen shown one gets a fair estimate of the dimensions of this foundation work. It is estimated that approximately 800 tons of concrete will be used in its construction, which is solid, reinforced. The highest pier shown in the figure measures 44 feet from the floor of the observatory. The exterior dimensions of the building can be judged from the ground construction work, as shown.



Piers for New Telescope, Little Saanich Mountain, B.C.

The first American complete building show will be held in Cleveland on February 16 to 26, 1916. It is anticipated that this will be a most powerful appeal to the builder in the interests of safety, beauty, comfort and economy in construction, equipment and adornment. The object is to reach the man-about-to-build, and it is said that $125,000 will be expended in educational exhibits. The show will be financed and managed by manufacturers and dealers whose only hope of profit is in stimulated interest in building.

Grade Separation Work in Winnipeg

Mr. W. P. Brereton, City Engineer, discusses the traffic conditions in that city and the growing need for more subways[*]

EVERY intersection of a highway with a railroad has erected thereon some device by which the public, travelling on the highway, is protected in a more or less efficient way, depending on the nature of that device.

These devices or constructions vary in their effectiveness from the ordinary painted cross-board with the words "Railway Crossing" printed thereon in large letters, and which depends for its efficiency entirely on the individual's eyesight, to some form of structure by which the railroad traffic crosses over or under the highway traffic, thus entirely eliminating any opportunity for an accident. Probably, properly constructed gates, with the proviso that a thoroughly competent operator be provided, would be considered as efficient a device as grade separation, for the elimination of accidents; but at intersections where the highway traffic is heavy and train movements frequent, it is found that the delay to traffic is such that grade separation is entirely necessary. It might reasonably be said, then, that grade separation is not absolutely necessary if the danger element only is required to be eliminated, but is rather a means of providing for the uninterrupted passage of pedestrians, street vehicles, and trains, as well as, providing for the elimination of the element of danger.

Elevated railroads constructed along the streets of the congested portions of cities and used entirely for the transportation of passengers from one point in the city to another is one of the best examples of grade separation, another is the construction of such railroads in tunnels under the surface of the streets. But as Winnipeg need not consider the necessity for such means of transportation for many years to come we will not consider them here, but confine our attention to the separation of steam railroad grades and street levels.

Usual Form Grade Separation Takes

This grade separation usually takes the form of either bridges, by which I mean structures for supporting the highway traffic above the grade of the railroad, or subways by means of which this traffic crosses the railroad underneath the grade of the latter. The former are probably more frequently met with in rural districts, where the topography of the country is rolling, and where, however, the construction is resorted to for the purpose of crossing tracks which are depressed for grade purposes more on account of the cost than for the purpose of affording an uninterrupted passage for traffic. There are also instances where bridges are adopted in cities, in which case the levels of the tracks and streets are such that the bridges are much more economical in first cost. But in cities which are level or almost so, subways are more frequently found.

In a matter of this kind there are two parties to be considered, the railroad company and the municipality. The interests of both must be looked after and injustice done to neither.

The first question to be decided is that pertaining to the necessity. There are no standards arrived at by any authoritative or advisory body by means of which this question can be definitely settled. I am afraid that it is settled too frequently without sufficient study. It is necessary, of course, to have thorough traffic checks taken and tabulated for different seasons of the year and made sufficiently frequent that the traffic during the different kinds of weather will be determined. Traffic should be so checked that the number of each of the following classes passing a given point in each direction for each hour be noted:

- Pedestrians
- Bicycles
- Light weight vehicles (such as buggies)
- Automobiles
- Motor Trucks
- Dray Waggons
- Train movements

When the count is tabulated per hour the peak of the traffic curve is given, which determines the maximum density of traffic, and if train movements occur at the same time the necessity for grade separation should be evident. But unfortunately there is no standard of density of traffic fixed which might be termed the necessity or critical point of density.

Importance of Location

There is one other question which does not receive sufficient study in many instances, viz.:—the location of the grade separation. We will take, for instance, the location of a subway crossing the C. P. R. west of Main Street. Opinions differ, but I venture to say that many opinions which have been voiced on this matter have been formed by a very superficial study. The ideal method would be by such a traffic check through Main Street subway and the present bridges west, that would secure from the individual vehicles the point from which the trip started and the destination point, as well as a memorandum of any calls made on the way. If the point of origination and destination were plotted by means of dots on the city map the eye would very easily locate the best point for a subway location to connect the centre of gravity of the areas affected on either side of the railway. Unfortunately, in the above case this kind of a check is impractical, as the traffic is too dense. The next best method is by thoroughly studying the street layout of the city, the trend of the traffic on the principal streets, and the probable result of the location of a subway at the different available locations, always bearing in mind that it is a very difficult matter to divert city traffic from a route through the business streets to one where the only business establishments are corner grocery stores.

If it has been decided that a subway should be built at any point, it is first necessary to determine the elevation of the track and the level to which the street can be depressed. Usually the railway company will oppose as much as possible the raising of their grade, as it naturally interferes so seriously with their sidings serving freight yards and private industries which should, if possible, be laid to the street grade. The city want the tracks raised as high as possible so as to reduce the percentage of the grade of the approaches, as well as the length of the same, and to interfere as little as possible with the public utilities constructed or to be constructed under the street surface.

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[*] Before Manitoba Branch Canadian Society Civil Engineers.

A very good illustration of the difficulties encountered by excess changing of the railroad grade from that of the surrounding land is found in the track depression of the Chicago, Milwaukee and St. Pauls Railway at Minneapolis, Minn., for a distance of three miles, involving about forty street crossings. The depression is about 20 feet. While this refers to track depression, similar difficulties would be imposed under certain conditions where the track is excessively raised.

Excessive Lowering of Street Level

There are good reasons for designing against the excessive lowering of the street level. Grades should not be so steep as to affect the hauling of normal loads in districts where heavy hauling is done. For horse traffic, occasional short grades of 2 to 3 per cent. have very little effect on the loads, but steeper grades could be adopted if only modern motor-truck traction had to be considered.

In Chicago 3.5 per cent. is the average where the grade does not exceed 100 feet in length, and 3 per cent. where the grades are longer. Five per cent. grade would be acceptable in strictly residential districts where there is not much heavy hauling. These limits hold good in level cities like our own, but in places where the grade on the street itself, near the location, exceeds this, nothing would be gained by confining to these limits.

Easy grades mean longer and more expensive approaches and greater property damage, therefore, the depression should be as little as possible.

Vertical curves are required at both the top and bottom of grades and the bottom of the grade should commence about 15 feet from the face of the superstructure.

If it is possible to avoid it the depression should not be such as to make necessary the installation of pumps to obtain drainage. It is much more desirable that drainage should be by gravity to the sewer. If this cannot be done, then electrically-driven pumps should be installed where frost will do no damage, and special arrangements made for attendance when they are required to be operated and inspected.

The headroom should be 14 ft. 6 ins. in the clear in subways through which street cars operate, according to the requirements of the Winnipeg Electric Railway Company, and 13 ft. 6 ins. otherwise. Other cities have different standards, depending largely on the type of street car in use. Where interurban cars are allowed to run through the city the headroom is usually between 15 and 16 feet.

It is not usually necessary that a subway should have the same clear width of roadway or sidewalk as on the adjacent portions of the street, as there is no occasion for vehicles to back up or stop at the curb or for pedestrians to cross each other's path, as in entering buildings or turning corners. It is the usual custom to locate columns on the sidewalk space just inside the curb line, and I see no valid objection to the location of columns in the centre of the pavement, or, where street car tracks are laid, on each side of the same, provided they are sufficiently protected by wheel guards or curbs. As a matter of fact, it is rather an advantage in that the depth of the girders in the superstructure can be reduced, thereby reducing the necessary depression in the street; the noise is reduced and the structure more easily waterproofed.

Main Street Subway, Winnipeg, Man.

Cost of Work is Chief Factor

Providing the above rules are adhered to the final determination of the amount of depression and the amount that the tracks should be raised should depend upon the cost of construction, taking into account the expense in reconstructing industrial spurs, etc., and all damages as a result of the grades in the street.

On account of the flat nature of the site on which Winnipeg is built, and owing to the fact that the railroads follow the course of the rivers for very short distances, and the fact that river transportation is exceptionally light, nearly all subways built, or to be built, are, or will be, such that railroad tracks need be raised moderately only, and street depression allowed.

The only exception is that of the Winnipeg Joint Terminals, where the tracks intersect Main Street at its southerly limit, and from there easterly along the main line of the National Transcontinental. The high elevation of the tracks at Main Street is, of course, necessary on account of the approach to Norwood Bridge over the Red River, and the fact that the right-of-way of the railway is along the river frontage.

There is also no depression of the street levels at Water Street, Notre Dame Avenue East, and Mill Street. West of Main Street to Osborne Street the elevation is reduced until, at Osborne Street Subway the grade is such that the street level is considerably reduced. Although this portion of the railway follows the river bank, at present no inconvenience results in the lowering of the track elevation, as no docks are located here, or will likely be located for many years; but it is necessary to have the position of the city in this matter strictly defined, so that at some future date subways may be built if required.

Probable Construction in Near Future

West of Osborne Street all streets are closed to Pembina Highway, at which point there will be constructed in the near future an adequate subway. Especially will this be necessary when the cut-off by way of River Park is placed in operation, over which through freight from both the C. N. R. and G. T. P. will pass. Depression of the street level will be necessary here as well as a new location of the street. This re-location is advisable not only for the sake of the construction cost, but also because it will be located immediately at the end of Harrow Street, which is an unbroken highway to the west end and north-west section of the city by way of Arlington Street.

On the C. N. R. cut-off provision is provided for a subway at the foot of Osborne Street in case the street is extended through to the river, and otherwise for a foot subway to the park.

On the C. P. R. a subway will probably be constructed at Talbot Avenue. This will be especially required should an interurban highway be opened by extending this street direct to the main street in Transcona, where eventually an electric railway line will probably be constructed. Between Main Street and the river ample subways have been constructed. But west of Main Street it is not unlikely that another subway will be built in a few years. A bridge is already constructed at Arlington Street and a subway at McPhillips Street. In this latter the street level is depressed below the sewer system, necessitating drainage by pumping, which has not been altogether satisfactory.

Eventually subways will be required at the intersection of the Pembina & South Western Branches of the C. P. R. with Logan and Notre Dame Avenues, and of the Pembina Branch with the intersection of Portage Avenue, Crescent Road, Academy Road and possibly one or more streets south of the latter, as well as one or more streets between Notre Dame and Portage Avenues. These latter, of course, would appear to be necessary only in the very dim future.

By agreement between the city and the Midland Railway Company, the provisions for grade separation are very clearly defined. This track extends from the south-westerly limit of the city, northerly, and then easterly, terminating at Paulin Street between Ross and Pacific Avenues. It is used entirely for freight traffic. The freight yards proper do not extend east of Isabel Street, and under the agreement no coal, wood, stone or junk yards, gravel dumps, or business purposes of a similarly objectionable character are to be used or carried on east of Isabel Street unless by by-law or resolution of Council. Switching across Isabel Street is allowed between the hours of 12 midnight and 6 a.m. This is, of course, a grade crossing. Subways are now constructed at Sherbrooke, Arlington and Tecumseh Streets and Elgin and Ross Avenues, with grade crossings at McPhillips Street and all intersections south. However, when certain specified things happen subways are to be constructed at McPhillips Street and all opened streets south to the city limits, including also two streets which may be opened south of Academy Road. The railway grade on the west approach to the present subways is one per cent. and on the east approach 2 per cent.

Water Street Subway

In the agreement with the C. N. R. by which Broadway Avenue, east of Main Street, and other streets, were closed to allow for the construction of the Union Depot, freight sheds, tracks, etc., provision was made for the construction of the Water Street Subway. This can be utilized, with some alteration, for the approach to the new highway bridge connecting Winnipeg and St. Boniface. There is, however, at present, a grade crossing near the subway where the Winnipeg Transfer Railway intersects Water Street. This is a somewhat dangerous crossing at the present time, and considerable precautions are taken to prevent accident. Trains are not allowed to approach at a greater speed than four miles an hour, a watchman is provided, and a new light has been installed to add to the safety at night. The construction of a subway here, or rather the extension of the present one, will, of course, be contingent to a great extent on the train movements in future.

Subways will probably be constructed at the intersection of the G. T. P. with Pembina Highway, Harrow and Cambridge Streets, some time in the future, but it is too early to predict any additional grade separation. It would appear that the street traffic would be required to be heavy before the work would be necessary, if the freight is carried over the C. N. R. cut-off, as the train movements would then be comparatively light.

A subway will eventually be required at the intersection of Cambridge Street and the C. N. R. The train movements here will probably be very frequent. It will not likely be necessary to obtain additional grade separation along this line for many years to come.

The Oak Point Branch of the C. N. R. would be subject to the same requirements as the Pembina Branch of the C. P. R. and the Midland Railway south of the Assiniboine River.

General Practice

It is not necessary to consider in this paper the detail design of subways, as there are no exceptional engineering difficulties to be met with.

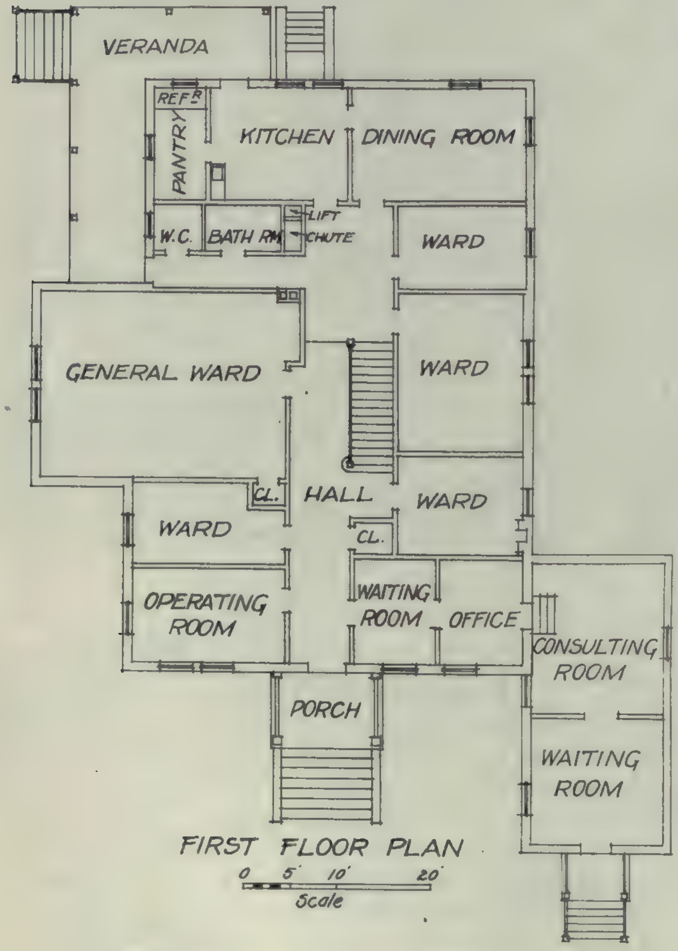
It is general practice to place the maintenance of the superstructure, retaining walls and foundations in the hands of the railway companies and for the city to maintain the sidewalks, pavements, underground utilities and drainage system. In some locations it is advisable to provide means by which temporary grade crossings can be placed in commission on short notice in case of a blockade. If there is a grade crossing near by this precaution is unnecessary.

The New Hospital at Grand Forks, B.C.

A Building of Colonial Design — Constructed with Concrete Blocks on Rubble Foundation—Accommodation for Thirty Patients

CITIZENS of the progressive town of Grand Forks, in the Boundary country south of Nelson, are justly proud of their new hospital building, which was recently placed in commission. A large number of men find employment in the mills and logging camps of the district, and in case of accident will now be able to secure the best of treatment and attention at Grand Forks.

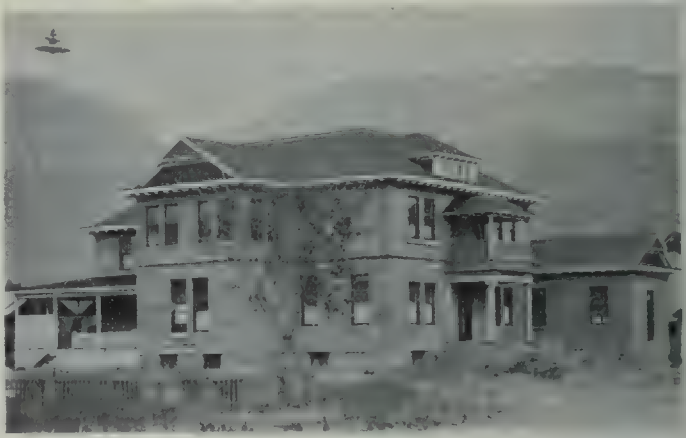
The building is of Colonial design and presents an attractive appearance. The main portion is 24 x 64 ft., two and one-half storeys, with a maternity wing 20 x 30 ft. It is constructed of concrete blocks on a rubble foundation. Accommodation is provided for thirty patients. The interior walls are finished in hardwall plaster and Keene's cement; the doors are flush panel, and throughout the aim of the builder was to avoid crevices and ledges to hold dust, and to present the smoothest surfaces for washing. Electric bells are fitted in each room, with annunciators on each floor. The different floors are served with lift for meals, etc., and a linen chute connects with laundry in basement. The operating room is tiled and equipped with the most sanitary appliances..



First floor plan of Grand Forks Hospital, B.C.

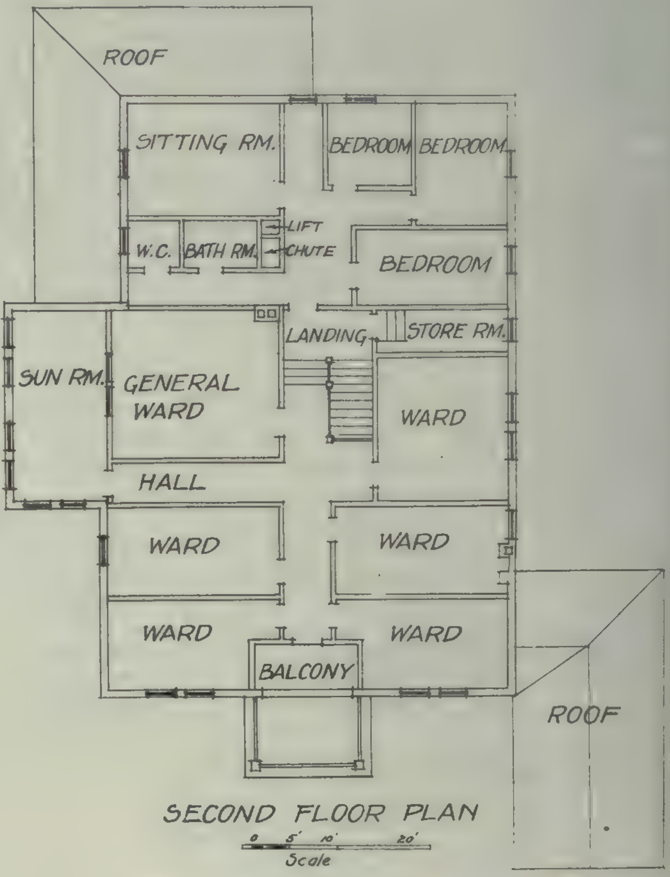
The basement is full size of building, well lighted, has provision for shower baths, and contains laundry, store, boiler and fuel rooms. Hot water heating is used, with direct indirect radiation in general wards.

Spacious quarters for the nurses are provided at rear of building. A balcony over the front porch provides a pleasant spot for convalescent patients and a verandah on the west side affords them room to walk about in the fresh air. A sun room is also provided for the use of patients when the weather is cool.



Grand Forks Hospital, B.C.

The building was erected without a general contract, the supervising architect being Mr. Wm. Farmer, of Grand Forks.



Second floor plan of Grand Forks Hospital, B.C.

The Longest and Heaviest Steel Arch

in the World, Forms the Monumental Link in New York Connecting Railway—1017 feet from pier to pier—300 feet above mean low water

For a good many years New York has constituted a gap in the railway lines running to and from it in all directions. Passengers arriving in New York from the north for the south had to transfer from one station to another. Similarly with north-bound passengers. And even a more roundabout state of affairs existed in forwarding freight. The New York Connecting Railroad was planned to do away with these vexations and delays.

The connecting line leaves the New York, New Haven, and Hartford tracks, spanning successively the Bronx Kill and Little Hell Gate, and crosses Randall's Island and Ward's Island to the west shore of East River. Reaching the east shore, by the Hell Gate Bridge, the longest and heaviest steel arch in the world, the connecting railway traverses a section of Long Island City, and turns westward, effecting a union with the Pennsylvania tracks at Sunnyside yard.

The Hell Gate Bridge is the monumental link in a line quite ten miles long, that will transform the city of New York from a vexatious halting place into a wonderfully efficient centre of distribution.

The route chosen for the connecting railroad was somewhat arbitrarily fixed by existing conditions, requiring that the railroad should traverse some populous sections of Greater New York, and run through areas of improved property. This required carrying the rails on high viaducts, not only to span thoroughfares, but to clear the right-of-way of certain elevated electric lines. On account of property values, and the exceptionally heavy nature of parts of the route, especially the Hell Gate Bridge, the ten miles will cost, when finished, quite thirty million dollars. The following data is from a recent issue of The Engineer.

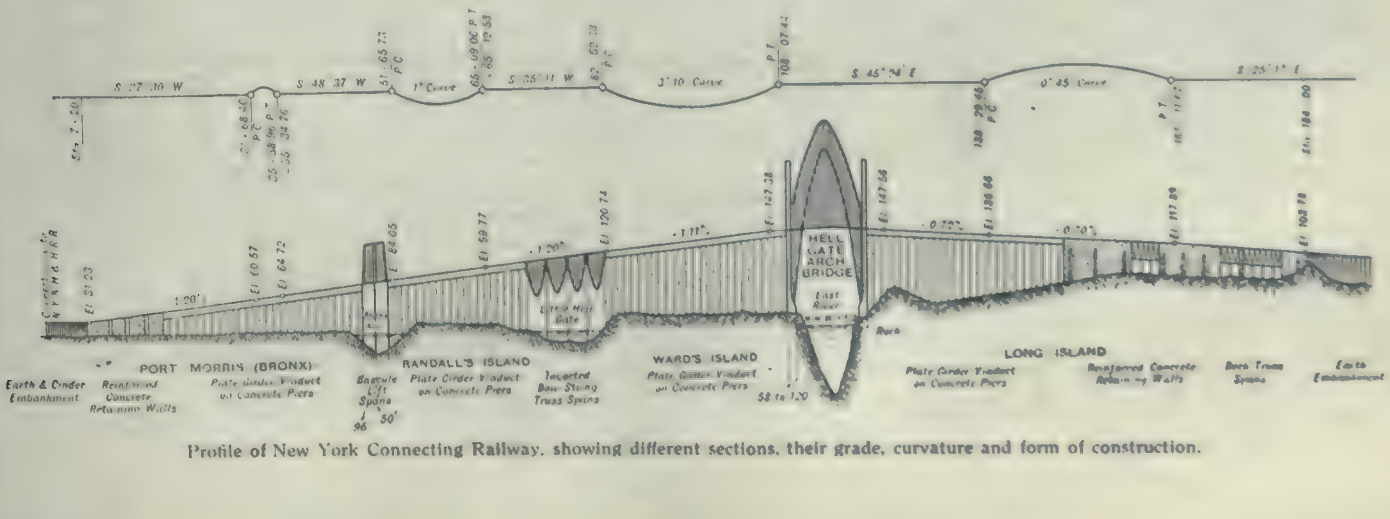
There are five viaduct sections, Fig. 1, which have the following characteristics:—The Bronx viaduct, seven-eighths of a mile long; Randall's Island viaduct, three-eighths of a mile long, and ranging in height from 75 ft. to 100 ft.; Ward's Island viaduct, half a mile in length, 135 ft high, and characterized by a sweeping curve of three degrees and ten minutes in effecting approach to, and contact with, the Hell Gate Bridge; Long Island viaduct, half a mile long and also 135 ft. high; and the Eastern viaduct, two-thirds of a mile in length and 72 ft. high. These viaducts have a total of 150 piers, and the constructions have called for 450,000 cubic yards of concrete.

The Long Island viaduct foundations rest on gravel 10 ft. to 30 ft. deep where the ground is saturated with water high above tide level and provision had to be made against the consequences of the ultimate draining of this land for the building of houses. Therefore concrete arches could not be used. Concrete piers with exceptionally wide foundations were resorted to in order to gain by spread the support necessary for the four heavily ballasted lines of rails. The Eastern viaduct consists of an earth-fill between thin concrete retaining walls—said to be the highest of their kind in the world.

On the west, the railroad has to cross the Bronx Kill and Little Hell Gate. As the first of these waterways will ultimately be dredged to make it navigable for good-sized vessels, it was necessary that a lift bridge should be installed there in anticipation of this improvement. The Bronx Kill structure is of the bascule type, and consists of two spans each 175 ft. long. The Little Hell Gate Bridge is of the inverted bowstring type, and is composed of four spans, set askew, with an average length on the centre line of 296 ft. 6 ins. each.

From pier to pier the Hell Gate span measures 1,017 ft., and from centre to centre of the end bearings the distance is 995 ft. The top of the arch is 300 ft. above mean low water, and there will be a clearance of 135 ft. beneath the suspended roadway at mean high water. When ready for service the bridge will carry four lines of railway—two for passenger trains and two for freight trains. The total dead weight of the finished span will be about 28,000 tons, but the arch must be fully equal to a live load equivalent to the burden of forty-eight of the heaviest of locomotives. That is to say, the loading at maximum stress would amount to 24,000 lbs. per linear foot.

The Hell Gate arch starts at each tower with trusses having a vertical length of 140 ft., gradually tapering until the centre of the span is reached, where the height is reduced to 40 ft. The width between trusses is 60 ft., and that between railings will be 93 ft. The lower chord is composed of a double rectangular section, starting with 6½ ft. by 11½ ft. at the lower end



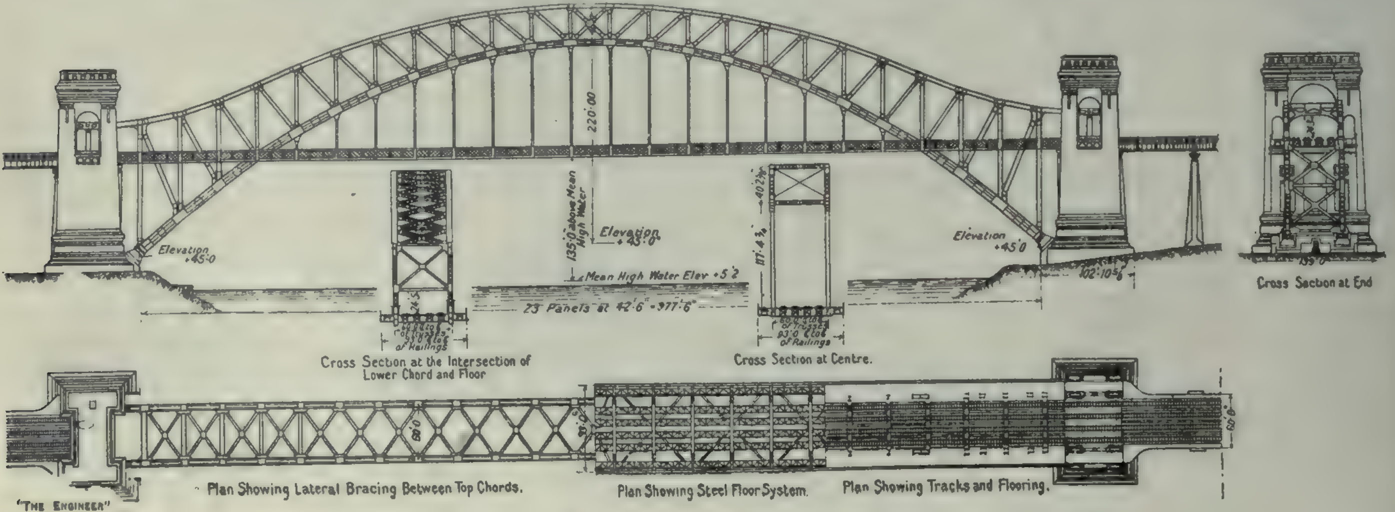
Profile of New York Connecting Railway, showing different sections, their grade, curvature and form of construction.

The Randall's Island Viaduct Section of the New York Connecting Railway.

and diminishing to 6½ ft. by 7½ ft. at the crown. The maximum section has an area of 1,384 square inches, and the heaviest single members, those of the lowermost ends of the lower chord, each weigh 185 tons. As we have said, the arch will carry, when completed, four sets of rails, and these will rest on solid concrete trough floorings. The heaviest rivets used in assembling the structure have a diameter of 1¼ in. and a maximum length of 11 in. The floor will be suspended by hangers, to which the beams will be attached by means of pins 16 in. in diameter. The floor beams are 93 ft. long and 9 ft. deep, and each will weigh 86 tons. Horizontal braking girders 8 ft. deep will be provided for taking care of traction forces. The largest gusset plates are 10 ft. by 17 ft. by 1⅝ in. The bridge has been erected temporarily on the cantilever principle, but it will ultimately stand as a single two-hinged arch supported by the flanking masonry towers, each 240 ft. high. Since the junction of the two sections of the arch in mid-river the bridge has become for the time being a three-hinged span—the third hinge being a little off the centre at the crown of the lower chord. For service, the desired rigidity can be obtained only by making the arch two-hinged, but provision had to be made against any possible settlement or yielding on the part of the supporting towers during the gradual increment of the dead load. The hinge at the centre will ensure this as the floor is added and the tracks and the ballasting increase the dead load. Finally, the two sections of the arch will be permanently secured, and then the third hinge will disappear, the two remaining hinges being at the lowermost points of contact with the towers.

During erection, deflections and stresses were measured very frequently by means of the transit, as well as by the extensometer. This called for some very painstaking work, because points to be observed were frequently hidden by intervening masses. Sagging was counteracted by means of very powerful hydraulic jacks. There were four of these, two at each tower. They had an individual capacity of 2,400 tons, and are said to be the largest of their kind in the world. When each section of the arch had reached riverward for six panels, the outer ends had a sag of quite 8 ins., and it was necessary to correct this deformation. From the top of the cantilever two more ties were employed to join the upper chord at the head of the sixth panel of each half arch, and by means of the hydraulic jacks the suspended structure was lifted to the required elevation.

Each end shoe at the river side and base of the tower is built in three tiers, and the weight is a mat-


220'0"
135'0" above Mean High Water
Elevation +45'0"
Elevation +45'0
Elevation +45'0
Mean High Water Elev +5'2
23 Panels at 42'6" = 977'6"
24'5
40'2¾
111'4¾
102'10⅝
Cross Section at the Intersection of Lower Chord and Floor
Cross Section at Centre.
60'0" c. to c. of Trusses
93'0" c. to c. of Railings
Cross Section at End
Plan Showing Lateral Bracing Between Top Chords.
Plan Showing Steel Floor System.
Plan Showing Tracks and Flooring.
80'0
60'0"

"THE ENGINEER"

Plan and elevations of the Hell Gate Arch Bridge.

Hell Gate Arch Bridge—Last members being hoisted into position.

ter of 275 tons. The shoes on the ends of the bottom chord are curved to form hinges, and each of these shoes will ultimately receive a thrust from the arch of 15,000 tons.

On October 1st the arch was closed by lowering jacks at both ends. When the halves touched, the amount of jacking checked within 1/32 in. on the Long Island end and agreed exactly with the calculations on the Ward's Island end. When the stays were released, the amount of jacking checked exactly on the Long Island half of the arch and was within 1/32 in. on the Ward's Island section. The total lowering amounted to 18 ins.

The foundation for the east tower rests on rock in an open cut but 20 ft. deep, while the tower on Ward's Island shore is supported on twenty-one pneumatic concrete caissons founded on rock at depths varying from 58 ft. to 120 ft. below ground surface. Somewhat kindred difficulty was encountered in getting a proper footing for the piers of the Bronx Kill Bridge. The trouble at the west shore of the East River was due to the fact that the underlying rock was crossed by a diagonal fissure, and the sinking of these caissons was a laborious undertaking, requiring quite seven months of continuous work. Despite the heavy pressures employed, none of the men was gravely affected. As soon as the "sand hogs" developed symptoms of bends they were promptly placed in the hospital lock and dealt with effectively. There was not a single fatality, and this is all the more amazing because the air pressure used in the case of the deepest foundation for the Bronx Kill Bridge piers reached a maximum of 52 lbs. to the square inch.

With the exception of the lift bridge over the Bronx Kill, all of the trackways will be heavily ballasted with stone. There will be footways along the entire route, and about every thousand feet there will be spiral staircases leading down to the ground by way of which passengers may obtain exit in case of accident or anything stalling the train. The locomotives for service on the connecting railroad will be electric.

Reduction in Parcel Postage Rates to France

The Honourable T. Chase Casgrain, Postmaster General of Canada, has been successful, as a result of negotiations entered into with the Imperial Postal Authorities, in effecting an arrangement with the British Government whereby parcels from Canada for Canadian soldiers in France and Flanders will be carried at the same rate of postage as applies to parcels from the United Kingdom for the Expeditionary Forces on the Continent; that is:

For parcels weighing up to three pounds..	24 cents
For parcels weighing over three pounds and not more than seven pounds	32 cents
For parcels weighing over seven pounds and not more than eleven pounds	38 cents

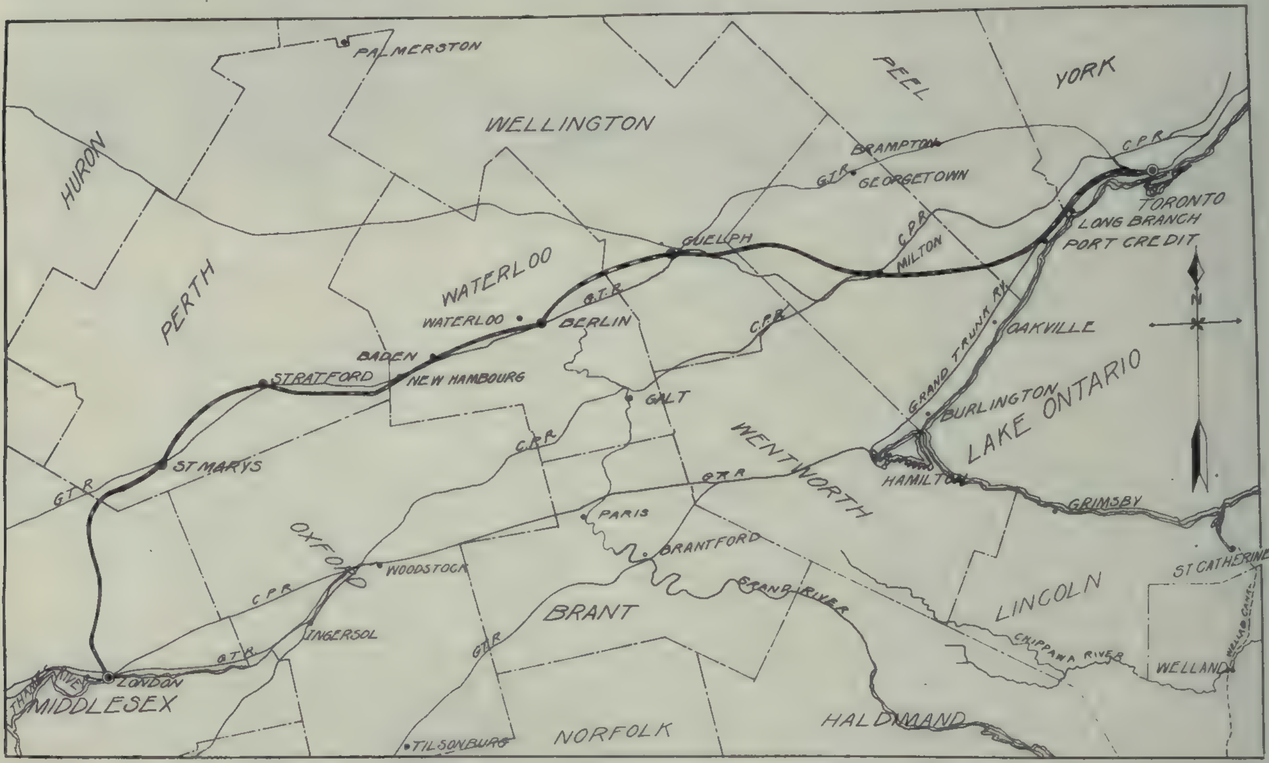
This means a material reduction on the cost of parcels, and it is hoped it will be a source of satisfaction to the Canadian public. This reduction has been brought about by Canada foregoing all postal charges for the conveyance of these parcels in Canada and on the Atlantic.

The public are reminded, however, in accordance with the circular issued by the Department recently, that until further notice, no parcel can be sent weighing over seven pounds.

An electric furnace plant for the manufacture of high grade steel is being installed in Montreal by the Canadian Electro-Products Company, recently incorporated with a capital of $500,000. It is proposed to establish two units each with a capacity of 25 tons of steel per day. Mr. Julian C. Smith, of the Shawinigan Water and Power Company, and Mr. J. S. Norris, of the Montreal Light, Heat and Power Company, will be among the directors of the company.

The Proposed Hydro Radial Scheme

In the map herewith the first section of the extensive hydro radial network, which the Hydro-Electric Power Commission of Ontario propose to construct, is shown. At the coming January elections by-laws will be submitted in practically all the municipalities concerned covering their share of the expenditure. The total amount of bonds to be issued in connection with this section of the road is placed at $13,734,155. This is for a total length of approximately 137½ miles, which works out to a bond issue of about $100,000 per mile. While this looks high, it may be pointed out that the type of construction would be the best obtainable; also an expensive Toronto terminal would be included.



The Toronto-London section of the Proposed Hydro Radial Scheme.

While the exact route of the road has not yet been determined, the following schedule is pretty close to what the Commission will likely finally adopt.

Toronto Terminal-Humber River Section:—From the passenger terminal located near the foot of Yonge Street the line will run westerly to Sunnyside, using Harbor Board property and private right-of-way wherever possible; thence to the Humber River the line will parallel the G. T. R., as at present constructed.

Humber River-Port Credit Section:—From the west limits of the city of Toronto at the Humber River, the line runs westerly parallel to the G. T. R. main line. It crosses the Credit River at a point between the Lake Shore Road and the G. T. R.

Port Credit-Milton Section:—Leaving Port Credit the line crosses the G. T. R. about one mile west, running thence to a point north of Sheridan P. O., and from there directly to Milton.

Milton-Guelph Section:—Crossing the C. P. R. west of the C. P. R. station at Milton, location runs to Township of Esquesing, thence to Township of Nassagaweya, thence to Township of Puslinch, and thence in the general direction of the Eramosa River to Guelph.

Guelph-Berlin Section:—From Guelph the line continues to Berlin, leaving Guelph in a westerly direction and entering Berlin from the north-east. The location lies north of the present G. T. R. between Guelph and Berlin.

Berlin-Stratford Section:—From Berlin the line runs to the G. T. R. main line, which it parallels to a point near Baden, and thence south of the G. T. R. to a point east of Stratford, where it will cross the G. T. R. and enter the city.

Stratford-St. Mary's Section:—From Stratford the line runs in a westerly direction parallel to the old main line of the G. T. R. to a point north of St. Mary's.

St. Mary's-London Section:—The line runs in a south-westerly direction through St. Mary's and thence westerly, crossing the Canadian Pacific Railway at grade, and over the Thames River, running thence parallel to the old main line of the Grand Trunk Railway to a point near Granton; thence in a southerly direction through Biddulph Township to the northern boundary of London Township; thence in a south-easterly direction from concessions 14 to 10, inclusive, in London Township. From this point the line runs in a southerly direction through concessions 9 to 4, inclusive; thence following the Thames River through concessions 3 to 1, inclusive, in London Township, to a point between the Sarnia Road and the Thames River, a short distance west of the Warncliffe Road outside the north-westerly boundary line of the city of London. Thence the line runs in a south-easterly direction over private property and city streets, crossing over the Thames River in the city of London, to a point on Bathurst Street; thence easterly along Bathurst Street to the London & Port Stanley Railway, which at present terminates on Bathurst Street, immediately east of Richmond Street.

Greater Winnipeg Water District

Progress of year's work towards obtaining a water supply from the Lake of the Woods—Preliminary work necessary to building—Construction methods employed

The Greater Winnipeg Water District is a corporation including the cities of Winnipeg and St. Boniface, the town of Transcona, the rural municipality of St. Vital, and portions of the rural municipalities of Fort Garry, Assiniboia, and Kildonan, all of which join the city of Winnipeg. This corporation was created by act of the Legislative Assembly on February 15, 1914, for the purpose of building waterworks to secure by gravity about 100,000,000 U. S. gallons of water per day from the Lake of the Woods, which lies about 100 miles east and about 300 feet higher than Winnipeg.

The location of the aqueduct was mainly on the insistence of Mr. T. R. Deacon, C. E., who was Mayor of the city of Winnipeg at that time, and who in his earlier days had been an engineer and land surveyor working in the Lake of the Woods and Shoal Lake region. For some years Mr. Deacon had felt that this body of water was an ideal one for the water supply for the city of Winnipeg. Acting on this, a location party was sent out on the line, and a feasible gravity route found, Shoal Lake finally being chosen by the District as the source of its water supply; permission was obtained from the International Joint Waterways Commission to divert the water.

Preliminary Work

The intake of the aqueduct is at the west end of Indian Bay, a branch of Shoal Lake which is itself a portion of the main Lake of the Woods. Indian Bay is about six miles long, from one to three miles wide, and is comparatively shallow, having a depth of from 24 to 26 feet over the whole area except in the immediate vicinity of the shores, which shoal up more or less rapidly. At a point near the intake of the aqueduct the Falcon River formerly discharged into Indian Bay, the dark brown drainage from some fifty square miles of muskeg country lying to the north-west. In order to prevent the discoloration of the lake water by this discharge of the Falcon River into it, the stream was diverted into Snowshoe Bay by a dyke 7,500 feet long, built across the end of Indian Bay, and by a diversion canal cut through the neck of land separating Indian Bay and Snowshoe Bay, which lies just to the south. This places the discharge of Falcon River some miles away on the shore-line, from the intake of the aqueduct.

The construction of this dyke was begun in 1914, and finished early in 1915, by Tomlinson & Fleming, using a 60-ton shovel and 4-yard cars. It is built of sand and gravel, riprapped on the side towards the lake, with a bed of heavy stones obtained from a quarry right at the end of the dyke. The dyke was formed by dumping the sand and gravel overboard from a bridge connecting the shore end with a scow held in position by spuds. The scow was gradually pushed out and the bridge dragged with it as the building proceeded. The top of the dyke was covered with top soil and seeded with Brome grass. The diversion canal was built by J. Anderson, of Kenora, Ont., using a floating dredge with a one-cubic-yard bucket. Following the construction of this dyke there has been a progressive reduction in the color of the water of Indian Bay.

The Construction Railroad

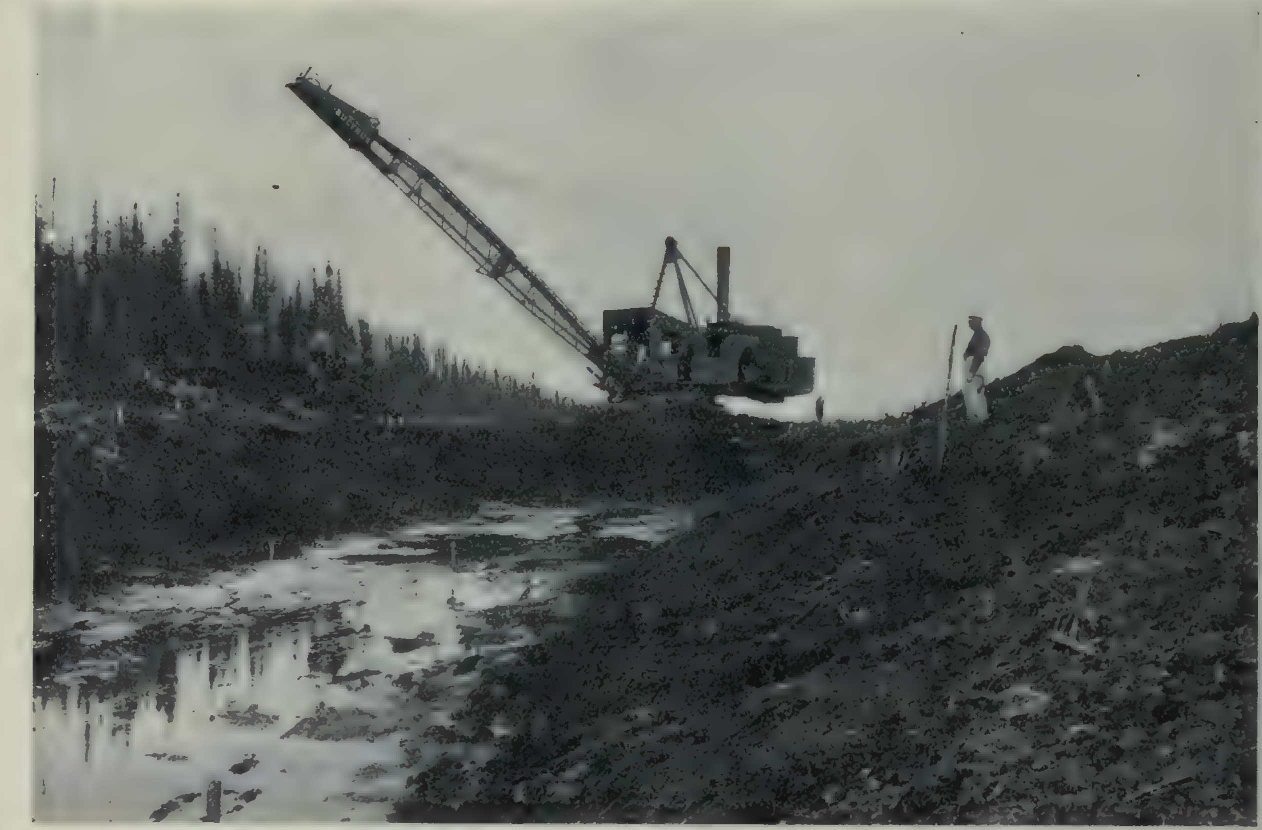
Prior to entering upon the construction of the aqueduct proper it was necessary for the District to do a great deal of preliminary construction work. No means of access were available for the delivery of material along the line of the aqueduct, the nearest railroad being fifteen miles to the north, and there being practically no highways over which material could be hauled, the line running through muskeg and country impassable with teams except in winter. The first work to be done, therefore, was to let contracts for the clearing of the right-of-way for the construction of a railroad from Winnipeg to the Lake of the Woods, and start the erection of a telephone line. The railroad has about 102 miles of track, including sidings, which cost about $1,225,000. It was built by the Northern Construction Company, of Winnipeg, who started laying the track in June, 1915, and finished in December, 1915. Coincident with the construction of the railroad a large amount of ditching and surface drainage was done by the District to free the ground of water in the vicinity of the aqueduct line as much as possible. Some of these off-take ditches are several miles in length.

The railroad parallels the aqueduct on 110-ft. centres, is standard gauge, with 60-lb. steel rails on a heavily ballasted roadbed. The ballast was hauled from two or three gravel pits along the line, opened up by the Northern Construction Company. The equipment on the line consists of four 52-ton Mogul locomotives, forty 20-yard air dump cars, twenty flat cars, ten box cars, three cabooses, and two coaches. Railway water tanks, sidings, miscellaneous railway buildings, and engineers' quarters were also built.

Location

The location of the aqueduct line required a great deal of patient, hard work. For the greater part of the distance the country is practically flat, the rise toward the east averaging three feet to the mile, the steepest slopes being not over about eight or nine feet to the mile. The whole country drops gently toward the north-west, but the fall is so slight that rain-water has great difficulty in getting away, and con-

Completed aqueduct with steel forms partly removed.



Ten-foot cut of clear muskeg--This machine, a class-14 Bucyrus, digs on the average 1000 cubic yards a day. Excavation running between ten and fifteen feet in depth.

Showing curve in viaduct, Greater Winnipeg Water District.

sequently has formed large areas of swamps, marshes and muskegs. The sub-soil throughout almost the entire distance is a sandy clay practically impervious to water. It is this condition of imperviousness, combined with the flatness of the country, which has caused the remarkably large areas of swampy land. In the course of ages these swamps have become over-grown with grasses and mosses; bushes and trees which thrive in wet places have sprung up generation upon generation, and gradually built up, upon the impervious sub-soil, water-soaked, compressible, spongy masses of roots and moss in a more or less advanced state of decomposition. In some places these masses or beds of moss and primitive peat reach great depths, some, a few miles to the north of the location of the aqueduct line, being known to be at least 70 feet in depth. The deepest muskeg so far encountered along the line of the aqueduct is about 15 feet. At mile 85, where the muskeg is quite deep, the bottom of the trench is being prepared for the aqueduct by placing therein a gravel bottom and driving piles along the sides, to carry the aqueduct, which will be reinforced with steel along this section for several hundred feet, on account of a soft, yielding sub-surface stratum.

Dragline operating among the stumps in timbered muskeg - Greater Winnipeg Viaduct.

It can readily be appreciated that running lines through a country such as above described is a tedious operation. The country is practically unsettled, excepting along the Brokenhead and Whitemouth Rivers, the only two streams worthy the name which cross the aqueduct line between Winnipeg and the Lake, and supplies had to be packed in on the backs of porters from the nearest railway, some 15 miles to the north, or brought up to the line of the survey in canoes on the Whitemouth River, or Brokenhead River or through the Lake of the Woods from the Kenora, which is some forty miles from the point where the aqueduct line reaches the Lake.

The preliminary surveys showed that a feasible line could be had between the two terminals, and the first work to which the engineers of the District addressed themselves was to determine whether such feasible line could not be materially improved. Two features of this line commended themselves for special consideration; one was to determine whether the summit cut where the aqueduct passed into the watershed of the Lake of the Woods from the watershed of the Whitemouth River could be reduced in depth, and the other was whether by increasing the length of the line and securing a grade more nearly approaching the average slope between the two terminals the total cost of the aqueduct could be materially reduced.

The country is so flat and so thickly covered with timber and underbrush that it was impossible to judge by eye of differences of elevation for any distance, and for this reason lines of levels had to be run to the north or south, and sometimes to both the north and south, of the preliminary lines, sometimes as much as eight or ten miles, in order to be able to place contours upon maps with sufficient accuracy to determine approximately the desired location. By pursuing this method and by then running more accurate levels over the line located approximately from the contour map, adjustments and modifications were made until finally a line was secured which passed through the critical points on the profile and gave the fewest changes of grade throughout the whole line. It is interesting to note that although the finally located line is longer by several miles than the preliminary line, careful estimates of cost show that it is cheaper by nearly a million dollars, the saving being largely in concrete.

The Aqueduct

The aqueduct proper, which will be 85.04 miles in length between Shoal Lake and the reservoir at Deacon, is being built of concrete, the section being arched or horseshoe shaped at the gravity flow sections, and circular at the depressed sections and under rivers. There are two Venturi water-meters, eight blow-offs and overflow weirs, five depressed river crossings, manholes every mile, and siphon culverts under the aqueduct at all ditches and creek crossings. The aqueduct and gravity flow sections will have an air space on top and in no place less than four feet of earth for frost protection.

The slopes and sizes of the aqueduct were given in the issue of the Contract Record of December 2, 1914.

Aqueduct Contracts

The work has been divided into five sections, and each section awarded as a separate contract; the first section, which is called Contract No. 30, is 20.064 miles in length, running from Deacon at mile 12.473 to mile 32.537. Contract No. 31 is 17.765 miles in length, running from the end of Contract No. 30 to mile 50.302. The next contract, No. 32, is 18.201 miles in length, running from mile 50.302 to mile 68.503. The fourth contract, No. 33, is 16.089 miles in length, running from mile 68.503 to mile 84.592, and the last contract, No. 34, is 12.919 miles in length, running from mile 84.592 to mile 97.511. The estimated quantities of work on each contract, with the names of the contractors and the prices bid, are given in Table I.

Among the boulders—Stone shown contains 6 cu. yds.

The contracts have not yet been awarded for the steel pipe line from Deacon to the Red River nor for the tunnel under the Red River, nor the 4-ft. cast iron pipe line leading to the Winnipeg reservoir. The contract has been awarded, however, for core borings at the Winnipeg River crossing preparatory to making plans for this tunnel work. The plans have not yet been drawn for the 250,000,000-gal, reservoir at Deacon, nor for the intake at Indian Bay, as these can be deferred until next year.

Excavation Plants

The depth of excavation varies from just the removal of the top soil to 26 feet, and contains almost all descriptions of material, from rock to quicksand. The construction methods used by the different contractors are quite interesting. J. H. Tremblay & Co., of Winnipeg, contractors for the western twenty miles, or contract No. 30, which is prairie section, the greater part being through cleared and cultivated lands, are excavating part of their trench with a walking dredge, and part with teams and scrapers.

The walking dredge is a barn-like structure carried on four pads, one at each corner with an intermediate pad at each side arranged so that by means of chains and winches the weight can be shifted from the four corner pads to the two intermediate pads, and the whole structure pushed forward by chains working on the legs resting on these pads. The machine straddles the trench and digs forward, throwing the excavated material to one side on a waste bank.

Thomas Kelly & Sons, of Winnipeg, are handling the next section, or contract No. 31, by means of station men and teams, and in the heavier cuts by specially designed Thew shovels, putting all their waste along the north side of the trench. This contract is part prairie and part muskeg.

Contracts Nos. 32, 33 and 34, comprising over 47 miles, have been let to the Winnipeg Aqueduct Construction Company, Limited, being a combination of the Northern Construction Company and Carter-Halls-Aldinger Company, both of Winnipeg. This was the only company to bid on all the work, but were only successful in getting three contracts. On most of these 47 miles the upper portion of the excavation is all muskeg, some places as deep as 16 feet. This muskeg region is very difficult to work in, and it was decided that it would pay to have a special class of excavator on this work. The design finally chosen was one submitted by the Bucyrus Company, of Milwaukee. These machines have several ideas not in general use on excavating machines of this kind. On account of the considerable cost of coal, which is about twelve dollars per ton, all these machines are fitted with superheaters and other devices for getting the greatest economy out of the coal. They are equipped with horizontal boilers, having shaking grates and using natural draught, feed water heater, pump and oil filter for feed water; they also have the boilers and steam piping lagged.

These dragline machines, as they are called, stand at the end of the trench and work backwards, the bucket being dragged towards the machine and then swung out to the side trench, dumping the excavated material along the south side of the trench to form an embankment upon which to place the track for the conveyance of concrete and other materials to the work. To support these machines, which weigh about thirty tons, and to facilitate moving in this boggy country, they are mounted and rotate on a structural steel

A Class-7 Dragline, digging muskeg and roots.

base, to which is securely bolted timber skids on oak shoes; under these are placed 6-inch heavy pipe rollers that run on 4 by 10-in. planks placed on what is really a heavy plank raft in sections 8 by 20 feet.

The machine moves itself forward by first picking up the pad nearest the end of the excavation and swinging it around behind itself in line with the trench, skids being then laid down upon the extension of the pads, upon which the machine pulls itself back by anchoring the drag line bucket in the ground behind, and dragging itself along on the skids on rollers made of 6-in. pipe. The rollers are then blocked and the machine proceeds with the digging of the trench. Moves are made very quickly, the machine doing its own grubbing for the placing of the pads.

Forms

All the contractors are using Blaw collapsible steel forms for the construction of the arch. The inverts are laid in alternate blocks 15 ft. long with copper expansion strips, having a V-shaped groove lengthwise of the centre, at the end of each invert joint, steel forms being provided and set accurately to line and grade for the finishing of the inverts. After a set of blocks has been laid and when the concrete is sufficiently hard, the headers are taken off and the intermediate sections then poured to make a continuous invert. The arches are built in 45-ft. lengths with copper expansion joints at each end, the whole length of arch being formed in one continuous operation. The interior forms are moved on travellers on a 2-ft. gauge track laid on sized blocks upon the invert floor and accurately lined up, the forms being carried on jacks integral with the travellers and lined up by means of turnbuckles on rods hinged to the traveller frame. After a section of interior forms has been put in place the carrier is run out and the forms bolted up tightly, their surfaces being made flush and uniform. The exterior forms are made in 5-ft. sections bolted together to form the full 45-ft. length and are handled in different ways by the different contractors; some take them apart and move them by hand; some pick up each outside half as a unit and swing it forward; and some have a special carrier made which straddles the whole construction in the trench and runs on an auxiliary track, directly outside the arch, which picks up the whole outside form for the full length of 45 ft. and transports it as a unit, to the next section. The arches are concreted in alternate lengths, the gap being filled by moving the forms back or forward as the case may be. Considerable difficulty has been had in holding the forms in line and surface during concreting owing to some structural imperfections and defects, but these are gradually being overcome and a system worked out by which the delays, now necessary to line up the surfaces and adjust the braces, will be greatly reduced.

Showing method of handling pads

For the screeding of the concrete in the inverts the most satisfactory device yet used on the work has been a 3½ by 3½ in. angle iron 16 ft. long with handles arranged so that two men can pull at each end. Lighter screeds are not satisfactory because they will not push down the stones in the concrete sufficiently to enable the finishers afterward to obtain a smooth surface. Considerable experience has been required in the handling of the screeds to get a good invert. If the concrete stones come to the surface the floating and troweling produces a wavy face no matter how much care may be taken by the men, but the heavy screed, moved slowly and in a way to press down rather than dig up the surface, produces a very good result by going over the face only two or three times; and the trowelers can then get a plank across the trench and trowel the surface to a very good finish.

To guard against leakage where the arch comes down upon the sides of the invert a strip of soft pine wood ⅝-in. thick by 1¾ ins. high is sunk into the concrete about half its depth throughout the whole length of each side of each pad; and where two invert blocks join a little pine plug is driven in tightly between the ends of abutting wood strips. Leakage between the invert joints themselves is prevented by the copper expansion strip already mentioned.

This strip is about 6 ins. wide and rolled with a groove about ⅜-in. high through the centre, the edges of the groove being crimped close together to prevent entrance of mortar when the concrete is placed. The copper strip is bolted tightly through the bulkhead at the end of the invert section, leaving about three inches to project into the concrete. The same detail is employed in the ends of the arches at the end of each 45-ft. length, the copper being bolted tightly into the bulkhead form at the ends of the arch.

It has been found quite difficult to educate the men placing the concrete in the arch forms properly to spade the material so as to prevent the formation of air holes on the interior face of the concrete. Most of the labor employed is foreign and few of the men can speak English, and, as is usually the case, they will persist in spading too violently and without interest in the work. Better results are being secured, however, as the work progresses, and some of the last arches poured do not show any imperfections or air holes.

The use of special forms for curved sections have been done away with by making the 45-ft. travelling forms in 15-ft. sections and setting these sections on chords to the true curve. As the forms would not telescope on curves, careful planning of the work was necessary to have all forms, except the form set for the curve itself, advanced past the curve before the curve was concreted. This avoided the loss of a day or more in passing each curve, which would otherwise have been taken in allowing the curved section to set so that the forms under it could be moved ahead to clear the way for moving up any form that might be left behind the curve.

In approaching a curve, the contractors were instructed to leave out the curved section until all forms but the one next the gap had been moved ahead. This last form was then to be moved ahead, set in the gap and concreted on the same day with the third form ahead of it. The two intervening forms meanwhile would be concreted on the two days previous, together with the two forms ahead of the advance form concreted with the curve. This made it possible to move the forms ahead two at a time, and to concrete two, strip two and set up two each day.

Foundations

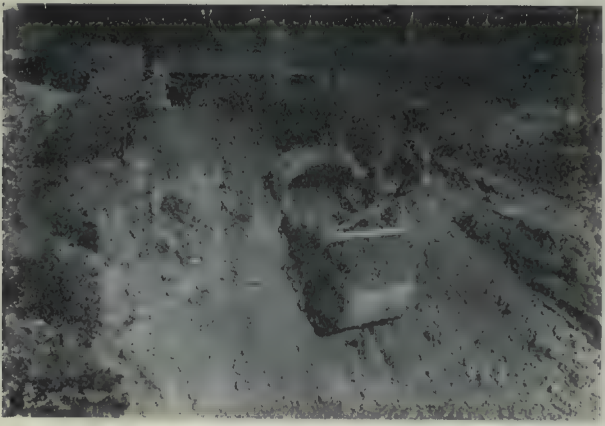
Throughout the greater part of the work so far done an excellent bottom has been obtained in the trenches, although in a few places springs have had to be stopped and considerable pumping resorted to in order to keep the water down. In some places the natural bottom has been too soft at the elevation of the invert to carry the work, and in such places the soft material has all been removed and an artificial bottom prepared by flooding the trench with water to a depth of a foot or two, dumping sand or gravel into the trench and casting it so that it settles into the water, the water level being kept always higher than the top of the fill. These foundation fills in cuts are carried up a few inches higher than the required elevation, and the water is then pumped or drained out of the trench, so that it passes down through the gravel instead of flowing off over the surface. By this means it has been possible to prepare a bottom so tight and hard that the invert can be laid on it almost as soon as the water is drained out, without fear of further settlement. The sand and gravel placed in this way pack so tightly that it is necessary to use picks and mattocks to do the trimming for the reception of the invert.

The material used for these foundation fills in cuts is, with the exception of a limited amount of pit-run material, the excess sand from the District's gravel plant, a material which would have to be wasted if not used in this manner, because the gravel pit contains more sand than is required to make an economical concrete aggregate.

District Furnishes Cement, Sand and Gravel

Under the contracts awarded for the construction of the works the District supplies its contractors with the cement, sand and gravel necessary for the construction of the works. The sand and gravel is delivered to the contractor on his platforms for 75 cents per cubic yard, and the cement is delivered to the contractor at the cost to the District, which cost includes the cost of the cement, cost of inspection, handling, hauling and delivering of the cement to the contractor with a rebate for the sacks returned. The contractor's prices for concrete include the cost of the gravel and sand, but do not include the cost of the cement, the cement being charged to the contractor as it is delivered to him, and credited as it is used in the work.

Under the adopted policy of supplying the contractors with sand and gravel, the District has been obliged to open a large gravel pit and install excavating machinery, tracks, dinkey locomotives, dump cars and a plant for grading the materials. The materials excavated from the pit are brought to this plant on an elevated track in 6-yard dump cars and dumped through a grizzly which leads to the floor of an elevator. The materials passing through the grizzly are carried by a belt and bucket elevator to a rotary screen in the top of the screen house, which separates the material into three sizes. The screen is in three sections, one having ½-in. holes, the next having 1-in. holes and the last 2½-in. holes. Since the material, as excavated from the gravel pit, contains a small percentage of moisture, it was found impracticable to screen it through fine screens owing to the clogging of the meshes. After screening, the materials pass from the storage bins under the screen through chutes leading to a belt conveyor, upon which the different sizes of material are spouted from the bins in the correct proportions to form a concrete aggregate. From the belt the material discharges into the boot of a second elevator which raises it to the top of the screen house and dumps it upon other belt conveyors which drop it into storage bins from which the 20-yard air dump cars are loaded. An inspector stands at the end of the lower belt conveyor and samples the materials carried by the belt, from time to time, and changes the proportions of fine, intermediate and coarse materials as required. The over-size, which passes through the rotary screen, goes back to a jaw crusher, which breaks up the stones, and they in turn are thrown back through the boot under the grizzly and carried up again to the rotary screen. A gyratory crusher has also been installed at the foot of the grizzly for breaking up large stones which will not pass through the 3-inch spaces between bars of the grizzly. The storage bins have not as yet been a success, the difficulty being that as the material drops from the belt into the bins the sand falls straight down and the stones, jumping further, run down the outside; this produces a very extensive segregation of the materials. Devices are now being installed, however, to prevent this, so that the storage capacity of these bins may be utilized. Up to the present time the only extra storage that has been available at the plant has been in the 20-yard air dump cars. The material is spouted directly to these cars from the belt without appreciable segregation. The plan proposed for preventing the segregation of the materials in the storage bins is to have a vertical telescopic chute in sections, hung at the end of each belt so that the materials will fall down through this chute; and as the chute fills up the lower sections will be raised progressively to allow the materials to spread as the bin fills up. It is a device used extensively in colleries to prevent the breaking up of the coal when loading into storage bins, and it is believed it will work successfully to prevent the segregation of the materials as loaded into the storage bins. No difficulty will be experienced in loading materials from the storage bins to the cars.


Class-7 dragline in hardpan—Capacity 400 cu. yds. per day.

Moving dragline across Birch River Bridge.

Progress Required

Construction work is now progressing on all the contracts, and by the end of this working season possibly ten per cent. of the entire aqueduct may be completed and backfilled. The schedule of progress required by the specifications calls for the completion of 18 per cent. by December 1, 1915; 31 per cent. by August 1, 1916; 50 per cent. by December 1, 1916; 65 per cent. by August 1, 1917; 85 per cent. by

TABLE I.—APPROXIMATE QUANTITIES AND UNIT CONTRACT PRICES ON WINNIPEG AQUEDUCT

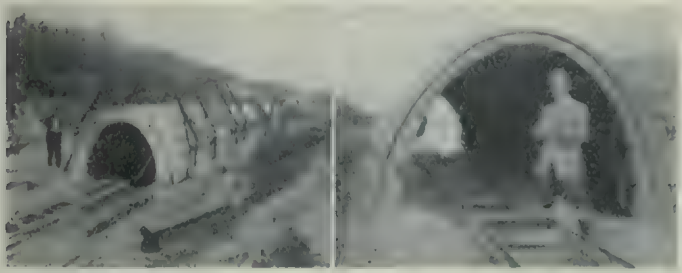
Description	Approximate quantities Contract number 30.	31.	32.	33.	34.	Measure	Unit prices Contract number J. H. Tremblay & Co. 30.	Thomas Kelly & Sons 31	Winnipeg 32	Aque. Co. 33	Cons' 34
1. Top soil excavation	121,000	20,000	15,000	13,000	2,000	Cu. yds.	$0.32	$0.50	$0.20	$0.20	$0.20
2. Earth excavation	190,000	......	......	......	......	Cu. yds.	.29	......			
3. Earth excavation	......	280,000	......	......	......	Cu. yds.	......	.60	......		
4. Earth excavation	......	......	358,000	......	......	Cu. yds.		......	.35	......	
5. Earth excavation	......	......	......	371,000	......	Cu. yds.	......	......	*1.50	.55	*1.50
6. Earth excavation	......	......	......	......	789,000	Cu. yds.				*1.50	.55
6A. Rock excavation	300	6,000	9,000	4,000	1,000	Cu. yds.	2.50	4.00	3.00	3.00	3.00
7. Refill and embankment	490,000	......	......	......	......	Cu. yds.	.20	......	......	......	......
8. Refill and embankment	......	429,000	......	......	......	Cu. yds.	......	.40	......	......	......
9. Refill and embankment	......	......	390,000	......	......	Cu. yds.	......	......	.25	......	......
10. Refill and embankment	......	......	......	314,000	......	Cu. yds.	......	......	......	.25	......
11. Refill and embankment	......	......	......	......	288,000	Cu. yds.	......	......	......	......	.25
12. Foundation embankment	24,000	113,000	98,000	13,000	36,000	Cu. yds.	.75	1.50	1.50	1.50	1.50
13. Sodding and seeding	161	95	97	107	87	Acres	15.00	200.00	100.00	100.00	100.00
14. Timber and lumber furnished and ordered left in place	1,300	2,700	1,600	1,700	2,400	M. ft. B.M.	37.00	37.00	45.00	45.00	45.00
15. Piling furnished and in place	......	40,000	600	3,000	3,200	Lin. ft.	......	.50	.60	.60	.60
16. Sheet piling furnished and ordered left in place	......	1,250	130	360	1,035	M. ft. B.M.	......	50.00	50.00	50.00	50.00
17. Concrete in aqueduct	73,500	72,200	65,700	65,620	72,000	Cu. yds.	6.50	6.25	9.90	9.90	9.90
18. Concrete in culverts, walls, etc.	700	2,200	725	960	500	Cu. yds.	7.50	8.25	12.00	12.00	12.00
19. Reinforcing steel furnished in place	3,320,000	1,460,000	200,000	227,000	137,000	Lbs.	.034	.045	.05	.05	.05
20. Cast iron and steel furnished and in place	45,000	6,000	8,000	6,000	6,000	Lbs.	.07	.09	.10	.10	.10
21. Cast iron pipes and specials furnished and in place	6,000	4,500	7,000	5,000	7,000	Lbs.	.055	.05	.15	.15	.15
22. Cast iron gates and valves furnished and in place	180,000	1,000	1,200	2,000	1,000	Lbs.	.30	.12	.20	.20	.20
23. Testing portions of aqueduct	100	100	100	100	70	Portion	300.00	200.00	300.00	300.00	300.00
24. Testing extra lengths	1,000	1,000	1,000	1,000	700	Lin. ft.	1.50	1.00	3.00	3.00	3.00

*Siphon excavation.

December 1, 1917; and 100 per cent. by September 1, 1918. In case the contractors fail to maintain the rate of progress stated in this schedule there is due and payable by the contractor to the District as liquidated damages $200 per day for each working day during which the work remains less fully completed than required at the specified dates, with the exception that prior to September 1, 1918, no damages are charged by the District between November 15th in any year and May 1st next following. In case the contractors' rate of progress improves so the amount of work accomplished at any of the stated dates shall equal the amount required to be done at such dates rebates will be allowed in compensation therefor.

Estimated Cost

The original estimates of cost of the complete work as made and as given in the report of the Consulting Engineers in 1913, was $13,045,600. On the basis of contracts already let there is reason to believe that the cost of the completed work will be about $1,000,000 less than this, including the cost of the construction railroad, the disposition of which, after the completion of the aqueduct, has not yet been determined.



Outside and inside forms Winnipeg aqueduct.

Personnel

The engineering work of the Greater Winnipeg Water District is under the direction of Mr. J. H. Fuertes, as Consulting Engineer, and W. G. Chace, Chief Engineer. M. V. Sauer is Assistant Chief Engineer in charge of all designs, and next in authority under Mr. Chace. The division engineers in charge of construction on the different contracts are: C. J. Bruce, Contract No. 30; R. T. Sailman, Contract No. 31; Geo. F. Richan, Contract No. 32; W. R. Davis, Contract No. 33, and A. C. D. Blanchard, Contract No. 34. Mr. D. L. McLean is assistant to the Chief Engineer and has had charge of all the studies of sands, concrete aggregates and cement testing, as well as of the permeability tests. Mr. R. W. Haven is also assistant to the Chief Engineer at headquarters. All these engineers have been on the work since the engineering corps was first organized, and participated in the surveys for the location of the aqueduct, the location and construction of the District's railway, the erection of the telephone line and the final location of the aqueduct.

Acknowledgments

For the information in this article we are indebted to the Excavating Engineer and to the Bucyrus Company of Milwaukee, who also supplied cuts; also to a paper presented by Mr. James H. Fuertes, consulting engineer, New York City, before the Western Society of Engineers.

At a recent joint meeting of Vancouver branch Canadian Society of Civil Engineers and the Vancouver section of the American Section of Electrical Engineers, an address on the Necaxa Power Development of the Mexican Light & Power Company was delivered by Mr. R. F. Hayward, managing director of the Western Canada Power Company, Vancouver, who has succeeded Mr. G. R. G. Conway, late chief engineer of the British Columbia Electric Railway, as president of the Vancouver branch. The address was illustrated with a large number of slides.

One frequently hears it stated by financial authorities that railway earnings are the best gauge of a country's commercial prosperity. Here are the earnings of our three big railways for the first week of December, as compared with a year ago:

	1915	1914	Increase
Canadian Pacific Railway			
	$3,046,000	$1,766,000	+ $1,280,000
Grand Trunk Railway			
	$1,012,326	$ 865,052	+ $ 147,274
Canadian Northern Railway			
	$ 830,600	$ 502,700	+ $ 327,900

The Uses of Electricity in Construction

and building operations—Increasing and indispensable

By J. E. Van Hoosear before Builders' Congress, San Francisco

A nation, race, or an individual does not stand still, they either advance or fall behind their neighbors. "Know more" has been the means of every advance. We are behind the level which has been reached by our competitors if we do not avail ourselves of the advances made in any line connected with our business, and it is my aim at this time to point out progressive methods on the power end of the construction game.

The service to which electricity can be applied in the construction of buildings, both small and large, and of any material, is increasing and will be found indispensable when the builders fully appreciate the worth of the electric motor-driven devices that are now placed at their disposal. It is the aim of the writer at this time to bring out the uses to which electricity is being applied through the motor and otherwise in building construction work, to the profit of anyone connected with the erection of buildings.

Work that can be done by means of electricity is limited only by the desires of the individual, and can be applied from the first operation of clearing a lot to the last operation of polishing the floors.

Starting with the pioneer work of clearing a heavily wooded site that is frequently encountered, a motor-driven wood saw is set up to work into cord wood any timber that may be standing on the premises; next, electricity is used to explode powder in removing stumps or rocks from the site; the excavation is accomplished by means of a motor-driven excavator which deposits the dirt into trucks that haul it to the dumps and in return deliver the rock, sand and cement that is used in the construction of foundation and walls. In a great number of places where the excavation is deep, large quantities of water accumulate, and it is necessary that this water should be removed in order to proceed with the foundation work; this is easily accomplished by means of a motor-driven pump, which needs very little attention, as it can be equipped with an automatic float switch, which will keep the water out night and day. From this stage on, a motor-driven saw will be found very serviceable to do all the rough sawing necessary in the construction of the concrete forms and the building frame.

The concrete used for foundation walls, floors and walks is mixed in a motor-driven mixer, and hoisted to different levels for distribution by means of a motor-driven lift supplied with a special dumping bucket. The bricks and other materials are also hoisted to the several floors by means of electric hoists, thereby saving time and adding to the efficiency.

Some little data have been gathered in connection with concrete work in regard to the quantity of power required in mixing and other work directly connected with it. In a reinforced concrete loft building of three storeys, 3,000 yards of material were used. A one-yard mixer driven by means of a 15 h.p. motor handled the material, a saw driven by a 5 h.p. motor cut all the lumber used in making the forms; these two motors consumed a total of 2,000 kilowatt hours, or about 1.5 yards per kilowatt hour. In a steel structure concrete building of eighteen storeys, using 1,782 yards of material, 829 kilowatt hours of electric current were used, showing a consumption of 1 kilowatt hour for each 2.15 yards mixed. The last named job was done by a contractor who owned several gas engine driven mixers, which he had been using for a number of years. He set one of them up to do this work, and after running a couple of days it developed troubles, causing delay and expense. An electric motor was then secured to complete the work, which it did in the usual satisfactory manner. Now, he, like many others who have taken the interest to look into the merits of electric-driven machines, will have no other mode of operation.

The plumber has not been left behind, and if the job is large, he will have motor-driven pipe and thread cutting machines on it to help him with his work.

If the outside walls are to be plastered, this can be speedily accomplished by means of a motor-driven compressed air plastering machine which will lay on a coat of cement plaster to any thickness desired. If the building is of steel structure, the beams can be hoisted and placed by means of an electric-driven hoist. In connection with the placing of steel, it has been the opinion of a large majority of those directly interested in this work that the operation can only be accomplished with satisfaction by means of the steam donkey engine; precedent, like a rut in a road, is one of the easiest things to follow, and one of the most difficult to get away from, and I presume is the solution for this. Upon a close study of the matter it is found that the reason for this contention is they either own engine-driven hoists, or have tried to do their work with improvised electric-driven apparatus which was found unsuited to the task, and being dissatisfied with results, would not listen to anyone regarding the up-to-date motor-driven appliances that have speed and control equal to the best of engine-driven hoists; it would be well for anyone who is contemplating getting new equipment to investigate the merits of the electric hoist.

After erecting the steel, the rivets that hold it together are driven home and headed by means of hammers operated with compressed air which is supplied by a motor-driven compressor.

The plaster which finishes the walls is mixed with motor-driven machinery that has been found to give a more thorough mix than was obtained by the old method.

In marble work, motor power is found necessary from start to finish, even to the chiseling and drilling that is necessary in the process of setting it in place.

In fine interior hardwood finish, the electric glue pot is found indispensable and is not a fire hazard.

A unique use has been found for electricity by one of our local builders, in the placing of an electric sign on a large building he was erecting, thereby availing himself of a modern way of advertising night and day the class of building erected, and in an up-to-date manner.

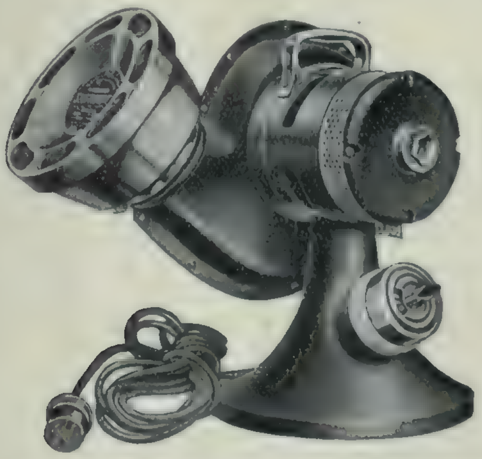
In the polishing of a great number of large floors of ball rooms, halls, etc., portable scraping and sanding machines have been built, and are operated by motors that form a part of the apparatus. No other mode of drive would serve the purpose, because of the necessity of cleanliness which could not be obtained if coal or gas were used for the purpose of motive power.

What may be of interest to this body is a unique method of mixing and delivering concrete, differing considerably from the old way, and can be used to advantage in cases where very heavy walls are to be built, or in places where the forms cannot be reached from above, and is accomplished by means of compressed air. There are two quite distinct patented ways of doing it. The first requires the usual motor-driven mixer, which in turn deposits the mix of about 20 cubic feet into the upper end of a cylinder shaped tank 4 ft. in diameter and 8 ft. long, cone shaped at the lower end and connected with an 8-in. pipe line that delivers the charge to the forms that may be located a considerable distance away, in some cases as far as 2,000 ft. The charge is driven from the receiver by means of compressed air under 100 lbs. pressure to the square inch at a rate of one charge per minute where the distance is around 300 feet, or about three minutes where the distance is 1,500 feet, and requires a 200 h.p. motor to drive a 1,200 ft. air compressor delivering at 125 lbs. pressure per square inch. The other method uses a smaller tank with 5-in. delivery pipe; the charge of about 10 cu. ft. of sand, rock, cement and water is delivered direct into the tank, no mixing machine being used.--The cover is then closed and the compressed air turned into the tank and forces the charge up to the desired location. In passing through the pipe line the material becomes thoroughly mixed. Both of these machines have been used on large tunnel jabs in San Francisco with satisfactory results in cost of delivery of material and quality of work, and there is no reason why they should not be used in building construction as satisfactorily.

There are many other applications of electricity that could be mentioned, as there are special appliances driven by means of electricity for any piece of work that has to be done in the construction of a building, and it is the policy of the central station companies to aid any party who is looking for information along this line with the object in view of further assisting their consumers in the use of their product.

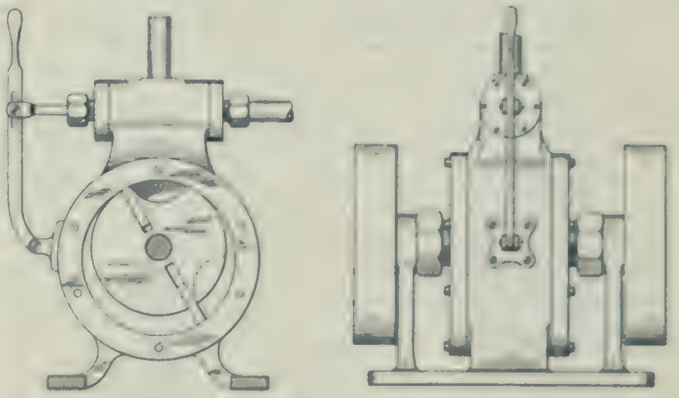
Sturtevant Heat Blower

An electric heat blower has just been placed on the market by the B. F. Sturtevant Company of Boston, Mass. This consists of a small motor-driven fan discharging air through heating coils placed in an aluminum casing. The forced circulation makes it possible to deliver a large volume of hot air in a short time. The apparatus is portable, and can be used in the same way as an ordinary electric fan or the regular cooking utensils in connection with any wiring system. The set is made in five different sizes, delivering air at one, two, or three temperatures, depending on the size. The fan outlet can be turned readily so as to discharge the heated air in any direction. One of these heat blowers is illustrated herewith.



Neely Steam Expansion Rotary Engine

A new rotary engine has recently been designed and put on the market by the Neely Rotary Engine Company, Limited, of Toronto. This engine is unique in type and an entirely new invention, and, although a radical departure from established practice in engineering, has stood up satisfactorily under very severe tests. The engine is simple in design, and entirely free from numerous complicated parts. There are no springs, rings, or packings used, and it has no dead centre. It is claimed it will start at any point and has steam expansion for three-quarters of a revolution. It consists mainly of a steam cylinder enclosing the rotary part, with a steam chest on top of the cylinder, all molded in one piece, as shown in cut. This steam chest follows somewhat the idea of the slide valve; it has two steam and two exhaust ports. A sliding valve connected to a lever allows steam to enter one port or the other according to position. The rotar consists of a cylinder of smaller diameter than the steam cylinder, with centre offset so as to bring the rotar in contact with the steam ports in the steam chest. This rotar contains two pockets with two adjustable nickel blades, as shown, one pocket and one blade each for forward and reverse. The pin used to hold the blade cushions the blade out steam-tight against the inside of the cylinder, by means of steam, so that there is no leakage. Steam enters the chest directly, and passes through the ports and into the pocket, impinging on one of the nickel blades for one-fourth of a revolution. The expansive power of the steam is used for the remaining three-quarters of the cycle.



Neely Rotary Engine—Side and End Views

The unique feature about this engine, apart from its saving in space and fuel and the absence of complicated parts, is the fact that when running at a speed of over 2,000 r.p.m. in either direction it may be brought to rest and driven to the same speed in the opposite direction almost instantly. This is accomplished by simply moving the valve in the steam chest, by means of a hand lever, to the other end, allowing steam to enter the opposite ports and so reversing the direction of rotation. When the valve is centred both ports are cut off, bringing the engine to rest. A few of the features of this engine which assure its success and efficiency are its simplicity, power, economy of operation, durability, and certainty of action and control. The same lever is used for starting, stopping, reversing and controlling the speed. The engine is free from vibration when travelling at high or low speeds.

Trade Publications

Revolving Shovels—Bulletin S. 14, containing a number of interesting photographs, with descriptive matter relative to the Erie shovel and its applicability to various classes of work. The title of the bulletin is "Facts, Figures and Photos"; issued by the Ball Engine Company, Erie, Pa.

Underground Construction—Booklet issued by T. J. Cope, 3244 North 15th Street, Philadelphia, Pa., describing, with illustrations, the various devices patented and manufactured by this company, with special reference to underground electrical construction.

In the Public Eye

A budget of comment presented in the interest of public welfare, independent of party politics and with malice toward no one.

Right here at the start let me say that this criticizing of the Government is no pleasant task. I am well aware that the publishers of this paper will get little credit for honesty of purpose. So accustomed is the public to the harpings of the party and corporation press that it has become case-hardened. It has learned to look through the printed articles for the self, party or corporation interest that prompted it. Let it be known then, once for all, that I prefer the Borden administration, with all its sins, to a Government controlled by a party that sought to tie us up to the United States with a reciprocity treaty. But this paper represents a constituency of business men. It realizes that they are tired of seeing politics practised where business methods should be applied. They know that honest criticism is the best medicine for any government—even if you have to hold its nose while you administer the dose. As I have said before, the publishers are not in a position to handle a war contract and do not care to farm one out. I myself have no desire to swagger around in an honorary colonel's uniform. Furthermore, none of the staff want to break into society. We have no fish to fry, soap to boil or peanuts to peddle. We simply want to show that petty politics are no satisfactory substitute for patriotism and that party machines cannot do the work of factory lathes. And permit me to say further, that we believe that things would have been just as bad and probably much worse if a Liberal government had happened to be in power when the war broke out.

* * *

Despatches from Ottawa indicate that the Government is firmly fixed in its resolution to side-step any and all enquiry into the "educative" work of the late lamented shell committee. It is evidently hoping that its work will be so covered by the improved methods under which the Imperial Munitions Board is working that it will be forgotten. But the charge that the sufferings of heroes have been capitalized and made to yield fortunes is one that refuses to die. The Ottawa Citizen, which was early in action against the "profiteers," returns to the charge with a statement that for machining 4.5 inch shells the Motherland has been forced to pay as high as $6.70 per shell, when the work could be profitably done for $2.25 per shell. It also gives figures to show that profits on other sizes of shells were proportionately large. What the public wants to know is how true these figures are. The public has a right to know, and it is going to keep on asking till it finds out. If it does not find out from this government it will find out from its successor.

* * *

That there are two sides to every story everybody will admit. There is doubtless some truth in Brigadier-General Bertram's story that he effected a saving to the British taxpayer of $14,000,000. It is also very probable that Mr. Cantley and the Nova Scotia Steel Company were entitled to consideration for the reason that they were the Canadian pioneers in shell making and invested considerable money in experiments before they succeeded in producing shells at a profit. Let those men have the credit that is due them. I would not for one moment rob any committee or any manufacturer of one iota of credit for anything that was done to relieve the Empire's great need for ammunitions. But credit can only be given by letting in light on the entire works of the Shell Committee. So long as that committee lies in an as yet unnamed grave the public will think only the worst of it and the government that was responsible for its existence. The fact that it was buried by the Imperial authorities adds to rather than detracts from the Canadian Government's responsibility.

* * *

If the Shell Committee had nothing to hide Canadians generally will rejoice. They will rejoice to know that the Motherland found in it a body of patriots whose every effort was given freely to her aid even as those Canadians have given their sons. They will rejoice to feel that rich as well as poor flocked to the colors prepared to lay down their last dollar and their last drop of blood that the Empire and civilization might triumph. They are proud of this young Dominion and would hail with enthusiasm the government that would clear her name of each and every charge of trafficking in blood and reaping fortunes from trenches filled with slaughter. It is a glorious opportunity that lies open to Sir Robert Borden and his Government—an opportunity to clear Canada's fair name of the foul calumnies with which the profiteering charges have clouded it. Surely such an opportunity will not be overlooked.

* * *

The Government has everything to gain and nothing to lose by being open and above-board in this matter. So many stories have been whispered, so many charges have been flung broadcast that to remain silent must simply be taken as an admission of guilt—an admission that the worst has not been told. Never since Confederation have so many stories of trickery, trafficking and grafting been afloat. They come to this office by the score. All cannot be given because all cannot be investigated. It would take a big staff working overtime to get into them all. But they pass from mouth to mouth, growing with each telling. Probably most of them have not yet reached Sir Robert Borden. His "machine men" probably see that such as do reach him are fumigated, sugar-coated and otherwise specially prepared for his consumption. But even his own party organs are hinting that makers of munitions "have striven to get large profits out of their contracts." The Toronto News (Conservative) charges it all to "stock market booming," but closes its article with the rather ominous sentences: "As in previous crazes a reckoning is coming. It may be close at hand and some very prominent men may be involved in the inevitable disclosures."

* * *

It is up to Premier Borden to see that the Conservative party and the Dominion Government are only not involved in, but wrecked by the inevitable disclosures. If he has that ability that was ascribed to him when the intelligent electors put him where he is he will rise above his "machine men" and investigate the deals in shells and shell boxes. He owes it to himself, to the great majority of his Conservative followers, to the country he represents and to the Empire we are fighting for.

* * *

Just one more instance of how the Shell Committee handled contracts. This story has been investigated and can be vouched for, as can the others that have from time to time found place in this column. The owner of a planing mill in an Ontario town went out after a shell-box contract. His application brought the usual answer that all contracts had been let. Imagine his surprise when a shipping clerk in a dry goods house in his own town secured a contract, put up a building, completed his contract and got a renewal. The shipping clerk had no plant, no experience and no business rating. But he knew a man who knew something about how contracts were got. Pretty wise man, wasn't he? Thrifty, too. For he still retains his job as shipping clerk, though he occasionally finds a few moments to run over to the shell-box plant and figure his profits.

* * *

How did he do it? Ask the average box manufacturer and his answer will be: "Search me." For strange to say, this shell game does not appear to have run along purely political lines. There are instances given where Liberals secured contracts and Conservatives could not get within hailing distance of them. Truly that shell committee moved in a mysterious way its wonders to perform. It might be put on as a movie mystery with a contract as a prize for the nearest guesser of its methods.

* * *

These be pessimistic times. What with criticisms of war methods in England, war contracts in Canada, and hyphenated Germans in the United States, it seems that there is a lot to holler about, and mighty little to holler for. But there is one thing that we can always look to and let our lungs loose in one loud and long hurrah. And that is the British navy. The "hearts of oak" have been modernized into hearts of steel. It has stood between civilization and the iron hand of Prussian militarism. And when the last battle of this war is fought and won—by the British, for some wise man has said "Britain wins only one battle every war, and that the last"—the credit and glory must go not to British arms or British gold, but to the grand old British navy.

* * *

By the way, has our old friend Sir George E. Foster found shipping yet for that million bushels of wheat he purchased for New Zealand? While he waited for the transportation so necessary to the completion of the contract did the price fall off 30 cents to 40 cents a bushel, entailing a loss of between $300,000 and $400,000? And when the blue book he edits makes its annual appearance will it have a full report of the whole painful transaction?

* * *

A prominent grain man, in telling why Canada should be prosperous, states that Manitoba, Saskatchewan and Alberta this year produced 700,000,000 bushels of grain, of which 300,000,000 bushels was wheat. He gives $450,000,000 as a conservative estimate of its value. Is it any wonder that the other week Winnipeg had larger bank clearings than Montreal, and that the Prairie City is entering on a new era of prosperity? And with millions of acres of this grain-producing land still waiting for the settler's plow why should Canada worry about the future?

* * *

Sir Sam Hughes reigns and the Ross rifle is still being manufactured. With these few kind words ringing in his ears Henry Ford may go on his peace mission with a full understanding that Canada still holds a full hand in the war game.

* * *

That all patriotic funds should be controlled and administered by the Government is amply evidenced in Toronto. A recruiting fund having been obtained by a "tag day" and other begging methods which tax the liberal and allow the penurious to go untouched, a quarrel is now under way as to its distribution. In England arrests have been made of people who sought to profit by the epidemic of giving for patriotic purposes. How much of this sort of thing is going on in Canada there is no way of finding out, but I hear of one entertainment for the good cause where the expenses amounted to $625 and the amount turned over to the cause was $25. There is but one remedy. The government should control all such funds. And it should also replenish them by a tax that would make everyone bear his share of the burden.

* * *

Down New York way they're still sending out circulars that tell of desirable investments created by filling war orders in Canada. One of the latest comes from Gilbert Elliott and Company. It advises clients to invest in Canada Foundries and Forgings Company, which has shops at Brockville and Welland. Here are the reasons given:

> "We are advised from sources upon which we can rely, that earnings for the past ten months ending November 1, 1915, are over $900,000, and that the monthly earnings are now running at the rate of $150,000, or equal to $1,860,000 per year, which, after taking care of fixed charges, will amount to over 150 per cent. per annum on the outstanding common stock."

The circular also stated that the company has within the past year filled large orders for shells for the British Government, in addition to its commercial business.

* * *

Right on top of this comes Sir Sam Hughes with a speech to Ward 4 Conservatives, Toronto. From a newspaper report of that speech the following is clipped:

> "Sir Sam related how, when the first order for 200,000 shells came to Canada, there were only four men in the whole of the Dominion who had the courage to tackle 'that little two penny ha' penny order.' It had taken a week and a half to even get them to face the issue.
>
> "Since then we have delivered four million shells," declared Sir Sam. "Upwards of $350,000,000 from shells alone has been placed in the pockets of the workmen."

Now taking the circular from New York with the story told by Sir Sam, who would you take "workmen" to mean—**the men who "worked" the Shell Committee** or the men who work in munition factories? If Sir Sam means the latter he is evidently talking arrant nonsense. If the workmen have got $350,000,000 in wages Canada must have shipped at least a billion dollars' worth of shells, for the cost of material and even reasonable profits would make the difference between the sums mentioned. Everybody knows that Canada has **not shipped** either a **billion** or half a billion dollars' worth of shells. Cabinet ministers should be required to know some little thing about what they are talking

* * *

Another excerpt from the report of Sir Sam's furious speech reads as follows:

> "Sir Sam said that men had gone to him with a white sheet of paper, in some cases with their sisters tagging on behind, and not a cent of capital, asking to get orders.
>
> "And these are the men who are making the complaints. I threw them out of my office as fast as they came in, and some of them were good friends of mine. Some of them were Tories, too."

And within a block of where Sir Sam spoke was a foundry capable of turning out thousands of shells daily, lying almost idle. And I can furnish Sir Sam with a list of men who have the factories and who could not get orders. If they are not complaining too loudly it is because they still have hopes of securing orders.

* * *

These attempts to belittle the manufacturers who have been wronged by the Shell Committee are unworthy of men of cabinet size. But the Shell Committee was a pet organization of Sir Sam and he is only following the policy of his party in trying to minimize those mistakes which lost to the manufacturers of Canada the greatest opportunity of a century.

* * *

Why did the Government lease the Transcona car shops to a private company for the manufacture of shells? Well, perhaps you had better ask D. A. Thomas. The Shell Committee was the part of the Dominion Government with which he came in contact. So when the Government proposed to start in to manufacture shells without saying anything about price you can imagine him throwing up his hands and exclaiming "Heaven forbid!" However, what he said to the Government was, "put in a tender." Well, you know that Shell Committee never did care for tenders, anyway. It just shied off and the Government with it.

* * *

A Yankee printer in a Canadian border town was fined $5 for working Sundays to get out labels for shell boxes. Seems a shame that the work could not have been done in the United States, where the Sunday laws are not so exacting.

SEARCHLIGHT.

"Pro Patria"

Lieut. A. M. West, city engineer of North Vancouver, B. C., left for overseas November 16th with a detachment from the 6th Field Company Canadian Engineers. Lieut. West was born in Ontario and is a graduate of the University of Toronto in the Engineering Department. After graduation he spent considerable time in railway construction, irrigation work, contour work and railway location survey work. In the summer of 1910 Lieut. West was appointed assistant city engineer of the city of North Vancouver, and his first duties consisted of assisting in preparing a contour map and levels of the streets of the city, which was followed by preparation of sewer and grading plans. He acted as assistant engineer during the construction of the sewer system and the grading and macadamizing of the streets, amounting to nearly $1,000,000 in all. In June, 1913, Lieut. West was appointed city engineer and acted in that capacity until November, 1915, when the Council granted him leave of absence to go to the front and serve his country, the resolution providing that his position be held open for him till the close of the war. In appreciation of his associations as a member of the city hall staff for the last few years, and in honor of his near departure, the staff of the city hall presented him with a beautiful wristlet watch, suitably engraved. The presentation was made by Mayor Hanes, who added a few words of congratulation suitable to the occasion.

Lieut. A. M. West.

Personal

Mr. Paul E. Mercier, the newly-appointed Chief Engineer of Public Works of the city of Montreal, is well known throughout the Dominion of Canada, and particularly in the province of Quebec. His father was the late Hon. Honore Mercier, one time Premier of Quebec.

Mr. Mercier was born in St. Hyacinthe, Que., in 1877, but was educated in Montreal, at St. Mary's College and L'Ecole Polytechnique, graduating from the latter institution with the Bachelor of Applied Science degree in 1899. His holiday periods were employed with the Canadian Pacific Railway Company, and after graduation he went to the Yukon, where he spent a year as assistant engineer of the Dominion Public Works Department, and two years as district engineer of the Yukon. On his return, Mr. Mercier was for two years engineer of Dominion Public Works for the district of Quebec, and from 1904 to 1907 was engineer in charge of work for the National Transcontinental Railway. In the latter year he returned to the city of Montreal and later formed a partnership with S. A. Baulne, under the firm name of Baulne & Mercier, a name well known in consulting engineering circles. In 1911 Mr. Mercier was appointed Professor of Railway Engineering at L'Ecole Polytechnique, and in 1913 joined the Board of Examiners of the Canadian Society of Civil Engineers. It was on May 16, 1914, that he first became connected with the Public Works Department of the city of Montreal as Deputy Chief Engineer, from which position he has now stepped up to fill the vacancy caused by the death of the late Major Janin.

Mr. Paul E. Mercier.

Mr. Mercier also holds important academic positions. He has been secretary of the Association des Anciens Eleves de l'Ecole Polytechnique since its organization, and has been professor of Transportation and Communication at l'Ecole des Hautes Etudes Commerciales de Montreal. He is a member of the American Railway Engineering Association, the Quebec Land Surveyors' Corporation, the Canadian Society of Civil Engineers, the Society of Civil Engineers of France, the Association International Congress of Navigation, and the American Society of Municipal Improvement. Finally, he is well known in military circles, being Captain of the Corps of Guides of the Canadian Volunteer Militia He also organized and commands as Major the Canadian Officers' Training Corps of Laval University.

Mr. C. C. Johnston has been appointed resident engineer in London, Ont., for the firm of Chipman & Power, engineers, of Toronto, while engineer E. A. MacGregor is away on active service.

Major the Rev. R. Bruce Taylor, Chaplain of the 42nd Battalion, who returned from the front recently, says that Major Janin, chief city engineer of Montreal, a victim of the Anglia, got a life belt on and was in the water when last seen. He was not killed by explosion or drowned in his bed as first reported.

Lieut. J. R. Cosgrove, formerly district engineer for North Vancouver, has been awarded the Military Cross for conspicuous gallantry on the field of battle. The district council have passed a resolution congratulating him, and are forwarding a copy of the resolution to him in France.

Mr. L. J. Conroy has been appointed president of the Master Plumbers' Association of Montreal, with Mr. A. Charette as representative on the Builders' Exchange.

Obituary

Mr. J. M. Dodge, who has been connected with the Link Belt Company, Chicago, since its very beginning, and was chairman of the Board of Directors, died on December 4. Mr. Dodge was one of the pioneers in the conveying and elevating art, and his inventive genius was a conspicuous factor in its successful development.

The death occurred recently of Mr. John M. Taylor, an aged and highly respected citizen of Fredericton, N. B., where he was born in the year 1832. During the active years of his life Mr. Taylor was engaged in mechanical engineering and machine work. When a young man he was a member of the fire department, and built many of the old-time hand fire engines used throughout New Brunswick. In 1883 he was appointed to the position of Chief Engineer of the city water-works, which position he filled for twenty-one years. Mr. Taylor was unmarried.

Mr. S. J. McClelland, of North Riverdale, Toronto, died recently. He was born in Adjala, Simcoe County, forty-nine years ago, and was in business there for many years as a building contractor. He came to Riverdale about six years ago.

The death occurred recently of Mr. Thomas J. Walsh, for many years chief engineer at the High Level Pumping Station, Toronto. He had only just returned from a three months' visit to the Pacific Coast. Mr. Walsh had been in poor health for some time, but his death came comewhat suddenly. He was well known in Labor circles, being a director of the Labor Temple Company.

William A. Conner Expires Suddenly

William Andrew Conner, of Plainfield, N. J., died suddenly Monday, December 6th, at his office in Perth Amboy, N. J. He was born in Baltimore in 1859. He began his business career in 1876, in Pittsburgh, in the oil refining business, in which he reached the position of assistant manager for the Standard Oil Company. In 1885 he took charge of the first plant built by the Standard Underground Cable Company in Pittsburgh, and from then to the time of his death he was the head of the manufacturing business of that company, including large plants planned and built by him in Pittsburgh, Pa.; Perth Amboy, N. J.; Oakland, Cal.; and Hamilton, Ont. He was a director for ten years and first vice-president since 1909. He was vice-president of the Perth Amboy Trust Company, in the inception of which he had an active part. He was also a vice-president and director of the Standard Underground Cable Company of Canada, Limited, whose factories were planned and built by him in Hamilton, Ont., in 1911-12. He was a 32 deg. Scottish Rite Mason, and a Knight Templar, a member of the Duquesne Club of Pittsburgh, the Hamilton Club of Hamilton, Canada, and the Plainfield Country Club. He has resided in Plainfield since 1904. He leaves his widow, who was Miss Tupper, of Michigan; a brother, Edward Conner, of Orange, N. J., and a sister, Mrs. Roak, of Brooklyn, N. Y. He was a cousin to Mr. O. T. Waring, of the Standard Oil Company, Mr. E. J. Waring, of Standard Underground Cable Company, and the late Richard S. Waring, who was the founder of the Standard Underground Cable Company and inventor of "Waring" Cables.

Mainly Constructional

East and West—From Coast to Coast

Wellington Building Corporation, Limited, Toronto, has been incorporated.

The International Steel Corporation, Limited, Toronto, has been incorporated.

The Montreal Steel and Foundry Company, Limited, has been incorporated, with head office at Montreal.

The International Steel Corporation, Limited, has changed its name to "Canadian Iron Ores, Limited."

The new infiltration plant for Snowdy Springs water supply at Moose Jaw, Sask., is reported to be working well.

A by-law has been passed by the ratepayers of Toronto for the laying of seventy-two thousand dollars' worth of sewers.

The Munro Steel and Wire Works, Limited, Winnipeg, are amalgamating with the Hero Manufacturing Company, Limited.

The main building of the Eastern Canada Steel Company's plant at St. Malo, Que., was damaged by fire recently to the extent of about $10,000.

Edmonton Cement Company, Limited, is the name of a company recently incorporated at Edmonton with a capital of one and a half million dollars.

A company known as The Manchester Iron Works, Limited, has been incorporated with head office at Calgary and a capital of fifty thousand dollars.

The Toronto Board of Control are again considering the erection of a bridge on Mount Pleasant Road, Toronto Works Commissioner Harris has prepared a report.

A firm known as B. C. Industries, Limited, has been incorporated with head office at Vancouver and a capital of ten thousand dollars, to carry on business as painters and decorators.

The Clark Drive outfall sewer, extending for 1,550 feet under the bed of Burrard Inlet, Vancouver, B. C., has passed the final inspection; the pumps have been removed, and water has been allowed to flow in from the sea.

The premises, plant, and merchandise of the Owen Sound Iron Works Company, Limited, will be offered for sale by public auction on December 29th. List of machinery and full particulars may be had from Kilbourn & Kilbourn, Owen Sound.

The United States War Department has sent a commission composed of ten engineers, geologists, and scientists to the Isthmus of Panama to investigate the cause of the slides of the Panama Canal and submit a report to President Wilson thereon.

The Montreal Builders' Exchange were represented on a committee which have drawn up a plan for civic administration, in place of the present Council. It suggests the reduction of the number of aldermen and the appointment of four controllers.

The work on the Quebec-Montreal highway has just been closed for the winter. The foundation of the road is complete with the exception of a few small sections which will be covered by next spring. The road is expected to be completed by the fall of 1916.

To cope with increasing business, the Western Machinery Company, Port Arthur, Ont., will move their plant from Lincoln Street to what was formerly the Hudson Garage on North Court Street. They are putting in some thousands of dollars' worth of new machinery.

The Orpen Company, Limited, have given notice of their intention to sue the city of Toronto for the payment of about $25,000 on account of extra work involved in the construction of a sewer on Bloor Street, west of Dundas Street, on account of quicksand having been struck.

The good judgment shown by the Utilities Commission in providing the city of Peterboro, Ont., with an auxiliary pumping plant was demonstrated a short time ago, when the plant was pressed into service for the first time, as a result of the main plant becoming disabled on account of frazil ice.

The annual convention of the Victoria and Vancouver branches and the first general meeting of the Provincial Division for British Columbia of the Canadian Society of Civil Engineers were held in Vancouver on the 11th inst., when amendments to by-laws and general business of the society were discussed.

L. S. Yolles, H. Rotenberg, L. M. Singer, and G. T. Walsh are the incorporators of a company known as the Wellington Building Corporation, Limited. The company will carry on the business of builders, wreckers, contractors, architects, and engineers. The head office of the company is in Toronto, and the capital stock $100,000.

The completion of the reclamation work at the foot of Wellington Street, Hamilton, Ont., which has been occupying the attention of the harbor commission, places at the disposal of the city over fifteen acres of the finest industrial sites in the Dominion, and it is expected that a number of factories will be erected thereon almost immediately.

The city of Montreal propose to expend during the winter $1,151,453 in the construction of sewers. About three-fourths of the work will be carried out in the north end of the city in St. Denis, Bordeaux, Notre Dame de Grace, Rosemount and other wards. The total amount to be spent in the eastern division of the city is $109,000; in the western division, $295,100; and in the northern division, $747,353.

The Builders' Exchange of the city of Hamilton, Ont., held its annual meeting on the 14th inst., for the purpose of electing officers for the year 1916. The following were elected: C. T. Pearce, local manager of the Pease Foundry Company, president; E. Kent, of Kent, Garvin & Company, builders' supplies, first vice-president; William Penny, of Bremner & Penny, contractors, second vice-president; James McNeil, treasurer; Messrs. Hannaford, Dennis, Ford, Murray and Somerville, directors.

At the annual meeting of the Calgary branch of the Canadian Society of Civil Engineers, held on December 4, the following officers were elected for the ensuing year: Chairman, Wm. Pearce; secretary-treasurer, Sam G. Porter; executive committee, H. Sidenius, A. S. Dawson and P. J. Jennings. Auditors, J. S. Tempest and S. K. Pearce. The branch plans to have a regular programme of luncheons with prominent members of the profession, and others, for speakers during the coming winter.

According to Mr. B. M. Metcalfe, chief boiler inspector of the province of Ontario, a new and much more thorough system of inspection of steam boilers is to be put in force in Ontario immediately. Every boiler which is not inspected by an insurance company is to be examined at least once a year by a government inspector. The importance of such inspection was emphasized by the explosion of a boiler at the plant of Wm. and J. G. Greey, manufacturers of mill furnishings, Toronto, on December 6th, as a result of which two men were killed outright and two others were scalded so badly that they died subsequently.

Maine's twenty-five-mile Federal Aid Highway, running from Portland to Brunswick, and declared to be one of the finest roads in the country, was recently opened to traffic. Hon. Philip J. Deering, chairman of the Maine State Highway Commission, was the first man to drive over the completed thoroughfare. The road is built entirely of bituminous macadam, of the finest type of construction, and is a section of one of the most important arteries of travel in Maine. It is a part of the coast highway to Bath, Rockland, and all the shore cities and resorts, and is also one of the units of the Portland, Brunswick, Augusta, Waterville and Bangor State highway.

That a contractor is in the position of the holder of a license to enter on lands for the erection of the building called for in the contract, and that if he insists on building another kind of building he can be put off the job, is the decision of Mr. Justice Middleton, who has dismissed the action brought by Mr. D. McInnis against the Port McNicol Public School Board and Architect Russell, of Stratford, Ont. The action was for $15,000 damages, because the defendants had the police put the contractor off the job when he refused to pull down and build properly a wall that was not according to specifications. He was erecting a four-room school. "There should be no sympathy for the plaintiff," says the judge, "as he acted badly. The improper work could have been undone at trifling expense, but he seems to have determined to defy the architect and provoke a quarrel."

At a specially convened meeting of the Advisory Board of the Sons of England Benefit Society for the district of Ottawa and Hull, held on December 4th, a resolution was unanimously adopted condemning the attitude of members of the City Council of Ottawa in considering the applications submitted for the position of City Engineer and Commissioner of Works. The Society "emphatically protest against the pernicious principle of considering the race, creed, or political affiliation of any applicant for civic office, instead of his professional qualifications and general fitness for the position," and urge that, as every section of the community bears its share of taxation and other communal responsibility, such discrimination is "reprehensible and indefensible"—especially at a time such as the present, when citizens from every part of the Empire are offering their lives for the protection of Canada and her institutions. "The best man should receive the support of the city's municipal governors," reads the resolution, "whether he be Canadian-born or a native of some other portion of the British Empire."

The Chicago Bridge and Iron Works have moved their general sales office, Chicago, from Washington Heights to 37 West Van Buren Street, (Old Colony Building), and have combined this office with their city sales office, formerly at 332 South Michigan Ave.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Barrie, Ont.
The Town Council will submit a by-law on January 3rd to authorize the borrowing of $7,500 for the completion of roadway construction on Bradford St. Clerk, E. Donnell.

Brockville, Ont.
The Roberts Filtration Company, Derby, Penn., who have been awarded tre contract for the construction of a filtration plant for the City Council will let sub-contracts for a number of trades, including brick work, concreting, roofing and steel work.

Dryden, Ont.
The Town Council have had plans prepared for the construction of a waterworks system, estimated to cost $24,800. Consulting Engineer, R. S. McKenzie, 1002 Union Trust Building, Winnipeg.

Dundas, Ont.
Plans are being prepared for watermains to be laid on a number of streets for the Public Utilities Commission. Chairman, R. W. Karch.

Hull, Que.
The City Council propose to lay sewers on a number of streets. Those on Scott and Chateauguay Streets will be laid at once by day labor. Engineer, J. P. A. Laforest.

Melfort, Sask.
The Town Council propose to lay concrete sidewalks on the main thoroughfares, at an estimated cost of $5,000. Chairman of the Works Committee, Councillor Dawson.

Montreal, Que.
The time for receiving tenders on the installation of a pump at the Papineau Avenue station has been extended by the City Council until January 4th.

Ottawa, Ont.
The City Council are about to construct a sewer by day labor, estimated to cost $425,000. Engineer, F. C. Askwith. Consulting Engineers, R. S. and W. S. Lea, 10 Cathcart Street, Montreal.

The proposed paving on Rideau Street will include 8,100 square yards of asphalt and 3,000 square yards of wood block. Tenders will be called in the spring. Engineer, F. C. Askwith.

Quebec, Que.
A report has been submitted to the City Council by Waterworks Engineer T. A. J. Forester on the the construction of waterworks and drainage services to the Quebec Abattoir, Limoilou Ward. Estimated cast, $25,000.

Sherbrooke, Que.
The City Council have authorized the construction of a watermain on Wellington Street, estimated to cost $4720. Superintendent of the Waterworks Department, F. McKeon.

Strathroy, Ont.
The Town Council will submit a by-law to authorize the construction of a watermain and electric lines to the basket factory. Clerk, E. W. Atkinson.

Unionville, Ont.
The Village Council have had plans prepared for the construction of a waterworks system, estimated to cost $14,000. The scheme will be considered by next year's Council. Engineers, James Loudon & Hertzberg, 79 Adelaide Street E., Toronto.

Walkerville, Ont.
The Town Council will submit a by-law on January 3rd to authorize the expenditure of $21,000 on the construction of pavements on a number of streets. Clerk, William Murray.

CONTRACTS AWARDED

Anderdon Township, Ont.
Robert Craig and R. E. Golden have awarded the contract for the construction of a quantity of tile drains to Walter Papst, Amherstburg, Ont.

Railroads, and Bridges Wharves

Delaware, Ont.
Tenders will be called shortly by the Middlesex County Council for the construction of a concrete and steel bridge over the Thames River. Engineer, Charles Talbot, County Buildings, London.

London, Ont.
The London & Port Stanley Railway Board are about to start work on the construction of extensions and switches. Work will be done by day labor. Manager, J. Calaghan.

New Brunswick Province.
Irving R. Todd, President of the St. John & Quebec Railway, Fredericton, will receive tenders until noon, December 30th, for the construction and equipment of the uncompleted portions of the line. Plans and specifications at office of the Company.

CONTRACTS AWARDED

Middlesex County, Ont.
The contract for the construction of concrete piers and abutments for the Delaware Bridge to be built over the Thames River has been awarded to the Webster Construction Company, Bank of Toronto Building, London, at $5,544.

Public Buildings, Churches and Schools

Beverley, Alta.
The Town Council are considering the erection of a Town Hall. A by-law to authorize the work may be submitted to the ratepayers. Secretary, H. W. Ormerod.

Hamilton, Ont.
The Board of Education are considering the erection of a school in the north-east section of the City, and the enlargement of the Robert Land School Secretary, R H Foster, City Hall

Point Du Bois, Man.
The City's Light and Power Department are preparing plans for a public school. Work will start in the spring Brick construction.

St. Catharines, Ont.
All work required in connection with the school which is being built for the Public School Board will be done by the general contractor.

St. Celestin, Que.
Work will start in the spring on the erection of a hospital for the Grey Nuns of St. Celestin. Brick construction.

Swansea, Ont.
Tenders are being received by W. Coates, 172 Windermere Avenue, on the installation of electric wiring and fixtures at a small hall.

Toronto, Ont.
A Committee appointed by Provincial Secretary W. J. Hanna have recommenced the erection of a Home for Feeble Minded. The building will be of the Cottage type and situated near Toronto. Approximate cost, $50,000.

Westboro, Ont.
The Public School Board are having plans prepared for a school to be erected on Broadway Avenue, at an approximate cost of $25,000. Architects, Richards & Abra, Booth Building, Ottawa.

Wolf Island, Ont.
Power & Son, Architects, Merchants Bank Chambers, Kingston, will receive tenders until January 1st for the erection of a church for the Congregation of the Sacred Heart. Plans and specifications with the Architects.

CONTRACTS AWARDED

Moncton, N. B.
The contract for painting required at the City Hall and market building now in course of erection has been awarded to Allan McDonald, 70 Downing Street, and the electrical work to A. B. Belliveau. Plastering by day labor.

Montreal, Que.
In connection with the presbytery in course of erection for the Trustees of St. Pierre Claver Church, Delorimier Avenue, the contract for wall furring, partions, etc., has been let to the Montreal Terra Cotta Company, Ltd., 42 St. Sacrament Street. Painting by the general contractor.

The Protestant Board of School Commissioners, Belmont Street, have let the contract for the supply of seats and desks for the Hamilton Street School to W. F. Vilas, Cowansville, Que. Heating will be done by the general contractor.

Port Hope, Ont.
The contract for heating and plumbing required at the new hospital has been

awarded to Millward & Company, Port Hope. The elevator will be installed by the Otis Fenson Elevator Company, Hamilton, and the call system by Signal Systems Company, Stevenson Building, Toronto. Painting by the general contractor.

Saanich, B.C.
The general contract for the erection of an addition to the Municipal Hall has been awarded to Arthur Stewart, care of Hector S. Cooper, Municipal Hall, Royal Oak. Amount of contract, $4,900.

Yarmouth, N. S.
The contract for alterations and additions to the Post Office fittings has been let by the Department of Public Works, Ottawa, to Thomson & Theakston, 116 Hollis Street, Halifax, N. S.

Business Buildings and Industrial Plants

Arner, Ont.
Hugh Low is considering the erection of fireproof barns. Estimated cost, $3,000.

Brantford, Ont.
The Lake Erie & Northern Railway Company are having plans prepared for a station to be erected at Colborne and Water Streets. District Engineer, J. S. Williams, 88 West Mill Street.

Cap Madeleine, Que.
The Union Bag & Paper Company, New York City, are considering the erection of a print and sulphide mill and other buildings. The company have options on some machinery.

Colchester North Township, Ont.
Thomas Batten, Malden Road, Essex, Ont., is considering the erection of fireproof barns to replace those recently destroyed. Approximate cost, $3,500.

Hamilton, Ont.
The Monarch Machine Tool Company are about to occupy the factory at Young and Ferguson Streets, and will make alterations to the building.

Tenders are being received on the plumbing and heating required at the addition now being erected at the factory of the Tallman Brass Company, Wilson Street. General contractor, W. H. Cooper, Clyde Building.

Hensall, Ont.
W. Rennie & Company, Ltd., 130 Adelaide Street E., Toronto, contemplate the erection of an addition to their warehouse. Work will not start until the spring. Approximate cost, $4,000.

London, Ont.
The Tuckett Cigar Factory has been leased by the City Council to the military authorities and will be converted by them into quarters for soldiers. Work will include partitions, heating arrangements and interior fittings. Particulars from Major Bishop, Headquarters Staff.

Mafeking, Ont.
Mutchenbacker Bros., have decided to rebuild their lumber mill, at an estimated cost of $20,000. Work will start in the spring.

Morrisbank, Ont.
David Miller, Wroxeter, Ont., is considering the erection of barns to cost about $3,000. Fireproof construction.

Orillia, Ont.
Work has been started on the erection of an addition to the factory of the National Hardware Company, 95 Barrie Road W. Estimated cost, $20,000. Construction is supervised by Boyd Saunders.

Peterborough, Ont.
A by-law will be submitted on January 3rd to authorize a loan to James Ellis and Bruce Quinn, 3 Hunter Street E., for the rebuilding of their factory, which was recently destroyed by fire.

Port Elgin, Ont.
John Coulter intends to build a garage in the spring. Prices on the work are now being received.

Quebec, Que.
The Eastern Canada Steel Company have started work on repairing the roof of their premises. Manager, L. H. Gaudry. The damaged machinery has been replaced.

Rossburn Man.
It is expected that the Rossburn Milling Company, recently incorporated, will start work shortly on the erection of a flour mill. Construction will be in charge of D. Pradninch.

St. Catharines, Ont.
The premises in course of erection for the Chemical Refinery Company are being built by lay labor. Material purchased.

St. Thomas, Ont.
The Wabash Railway Company, St. Louis, Mo., propose to enlarge their roundhouse and repair shop and to extend their yard trackage. They also contemplate the purchase of one large steam derrick and the laying of 100-pound rails between Windsor and Buffalo. Purchasing Agent, T. J. Frier, St. Louis, Mo.

Strathroy, Ont.
The Hospital Board are considering the construction of permanent foundations under their barns and the laying of new floorings. President, L. H. Dampier.

Tilbury, Ont.
H. Lewis is preparing plans for a business block to be erected on Queen Street for Forbes Bros. Fireproof and brick construction. Estimated cost, $8,500.

The business block in course of erection on Queen Street for Forbes Bros., is being built by day labor.

Toronto, Ont.
The Toronto Plaster Company, 1062 King Street W., are about to start work on the erection of a warehouse at Queen Street and the Don Esplanade. Frame and galvanized iron construction. Estimated cost, $3,000.

Victoria, B. C.
The Dominion Construction Company, 509 Richards Street, are receiving tenders on the supply of lumber, sand, gravel, cement and common brick, required in the erection of a warehouse for the Imperial Oil Company, Ltd., 404 Abbott Street.

Wakaw, Sask.
The Golden West Milling Company, Connaught Block, Saskatoon, will start work immediately on the erection of a flour mill. The Company propose to build a number of mills in the Province.

Welland, Ont.
J. R. Sidey is receiving tenders on alterations to a business block on East Main Street. Tenderers must submit competitive plans.

CONTRACTS AWARDED

Guelph, Ont.
The following contracts have been let for the erection of an addition to the packing house owned by Charles W. Barber. Elizabeth Street:—masonry, Richard Hewer, c|o the Architects, Tanner & Tanner, McLean Building; carpentry, Beattie & Eaton; roofing, S. & G. Penfold, Macdonell Street; painting, R. H. Barber & Sons, 85 Norfolk Street; heating, F. Smith, Quebec Street. The Architects will purchase equipment, including hog track switches, hangers, etc.

Kingston, Ont.
Work has been started on alterations to a building owned by Susman & Cohen, Ontario Street. The carpentry contract has been let to W. J. Gates, 214 Alfred Street, and the heating and plumbing to Lemmon & Sons, Wellington Street.

London, Ont.
The general contract for the erection of a process building in the Fair Grounds for the City Council has been awarded to R. Wilson & Son, 5 St. George Street. The Council will lay concrete foundations by day labor. Approximate cost, $3,700.

Montreal Que.
Robertson Bros., 10 Chestnut Street, have commenced the erection of a warehouse on Felix Street for the Montreal Electric ompany, 425 St. James Street. Brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $5,750.

Quebec, Que.
The contract for roofing required at the club house in course of erection for the Quebec Curling Club has been let to N. Barbeau, Bridge Street. Plastering by the general contractors.

Regina, Sask.
The contract for painting in connection with the office and warehouse which is being built for the Robert Simpson Company, Queen and Yonge Streets, Toronto, has been awarded to W. R. Talbot, 21st Avenue and Angus Street, and the electrical work to the Northwestern Electric Limited, 107 Kerr Block. Plastering by the general contractors.

Sherbrooke, Que.
The contract for heating in connection with the addition to the market building on King Street has been awarded by the City Council to A. R. Wilson, 4 Frontenac Street.

S. Thomas, Ont.
The contract for electrical work required at the office building which has been erected for the Huron & Erie Loan Company, 336 Talbot Street, has been awarded to C. W. Howkins, 283 Talbot Street, and the painting to Charles Schultz, 711 Talbot Street.

Toronto, Ont.
The Board of Control have awarded the general contract for the erection of a public lavatory on Keele Street to the Britnell Contracting Company, 1200 Yonge Street. Brick and tile construction.

Westport, Ont.
H. C. McEwen has let the general contract for rebuilding his store to M. J.

Speale. Work will start early in the spring. Frame construction, metallic sheating. Approximate cost, $8,000.

Windsor, Ont.
Work has been started on the erection of a bank building on Ouellette Avenue for the Merchants Bank of Canada. The contract for supply of stone has been let to the Ritchie Cut Stone Company, 191 Grant Avenue, Hamilton. Other subcontracts not yet awarded.

In connection with the remodelling of business premises on McDougall Street for the Windsor Ice & Coal Company, the contract for the installation of auxilliary and ammonia compressors has been let to the Canadian Ice Machine Company, 82 Chestnut Street, Toronto, and the contract for cork insulation to G. F. Pine, Detroit.

Residences

Beauceville, Que.
Israel Huard has commenced the erection of two residences to replace those recently destroyed by fire.

East Bruce Township, Ont.
Work has been started by Hector McKinnon, Concession 4, Kincardine, Ont., on the erection of a residence. Frame and white brick construction, concrete foundation, shingle roofing. Estimated cots, $3,000.

Exeter, Ont.
W. C. Snell proposes to erect a residence at an approximate cost of $4,000, and will call for tenders at an early date. Concrete and brick construction.

Hamilton, Ont.
Plans are béing prepared for a residence to be erected on Aberdeen Avenue for A. W. Goodes, Superintendent of the Provincial Hydro Station, Dundas. Brick construction, shingle roofing. Approximate cost, $4,000. Architects, Osborn & Ellis, Lumsden Building, Toronto.

London, Ont.
T. Wilkey, 525 Ontario Street, has commenced the erection of a residence, estimated to cost $3,200. Red pressed brick construction, concrete foundation, shingle roofing.

Montreal, Que.
Work has been started by Edmond Gravel, 58 Fabre Street, on the erection of two flats on St. Clair Avenue. Subcontracts will be let for some trades. Brick veneer construction, concrete foundation, felt and gravel roofing. Approximate cost, $4,000.

Thomas Lamb, 513 Aryle Avenue, will shortly start work on the erection of two flats on Marchmont Avenue. Estimated cost, $12,000.

Montreal West, Que.
J. J. Kirkpatrick, 37 Fenwick Avenue, is about to start work on the erection of a residence on Campbell Avenue. Estimated cost, $4,500.

Mount Bridges, Ont.
The erection of a' residence is contemplated by C. W. Dingman, c|o B. W. Fisher. Estimated cost, $3,000.

Niagara Falls, Ont.
R. J. Jolley & Company, Stanley Street, have commenced the erection of a residence on Victoria Avenue. Brick construction. Aproximate cost, $3,000.

A. Smith, South End Post Office, is building a residence on McRae Street, estimated to cost $3,000. Contracts will be let for plumbing and electrical work. Frame construction.

Ottawa, Ont.
W. C. Leech, 140 Spadina Street, has started work on the erection of a residence on Irving Street, estimated to cost $4,000. Brick veneer construction, stone foundation, shingle roofing.

Sydney, N.S.
The Dominion Coal Company, Glace Bay Street, are having plans prepared for a residence to be built on Kings Road.

Toronto, Ont.
Plans have been prepared for a pair of residences to be built on Park Avenue for C. H. Barnett, 66 Gloucester Street. Brick construction, shingle, felt and gravel roofing. Estimated cost, $5,000. Architect, C. F. Wagner, 18 Toronto Street.

T. W. Robinson, 11 Evelyn Crescent, has commenced the erection of a residence on Woodside Street, estimated to cost $4,000. Smaller trades will be let. Brick construction, concrete foundation.

Work has been started by Lankin Bros., 14 Furniss Avenue, on the erection of a pair of residences at 60-62 Fifth Avenue. Smaller trades will be let. Frame and brick construction, felt and gravel roofing. Estimated cost, $4,000.

W. Humphrey, 83 Wellesley Street, is building a pair of residences at 57-59 Kent Road, estimated to cost $3,000. Brick construction, shingle roofing. Smaller trades will be let.

H. A. Johnston, 63 Normany Boulevard, is about to build a residence, estimated to cost $3,000. Brick construction, shingle roofing.

H. A. Johnston, 63 Normany Boulevard, has decided to build two residences on Normany Boulevard, to cost about $3,000 each. Brick construction, shingle roofing. Work will start shortly.

W. Williams, 33 Cloverdale Road, has commenced the erection of a residence on Dufferin Street. Brick construction, shingle roofing. Approximate cost, $3,000.

Work has been started by H. Lucas, 118 Felstead Avenue, on the erection of a pair of residences, estimated to cost $4,000. Smaller trades will be let. Brick construction, shingle roofing.

W. A. Scott, 125 Mutual Street, has commenced the erection of two residences on Beech Avenue. Smaller trades will be let. Brick construction, shingle roofing. Estimated cost, $3,500 each.

Work has been started by William Hughes, 59 Amroth Avenue, on the erection of two pairs of residences, estimated to cost $7,000. Brick construction, shingle, felt and gravel roofing. Smaller trades will be let.

Work has been started by Robertson & Wills, 43 Berwick Avenue, on the erection of a residence at 103 Garden Avenue. Brick construction, stone foundation, shinle roofing. Smaller trades will be let. Estimated cost, $3,000.

Hayward & Whiterorn, 6 Hallam Avenue, have commenced the erection of a residence at 19 Lauder Avenue, estimated to cost $4,500. Tenders are now bein received for heating and plumbing. Brick construction, stone foundation, shingle roofing.

John P. Lever, 12 Rosemount Avenue, will shortly commence the erection of a residence on St. Clair Avenue estimated to cost $5,000. Tenders are now being received for excavation. Brick construction, shingle roofing.

CONTRACTS AWARDED

Hamilton, Ont.
The following contracts have been let in connection with the residence which is being built for R. Kirkpatrick, 153 Herkimer Street:—carpentry, J. K. Ireland, 161 Hess Street; plastering, Charles Chewter, 273 East Avenue W.; painting, James Ingram, 88 24th Street.

Montreal, Que.
The general contract for alterations to a store at 59 Park Avenue for Barton Dixon, 83 Craig Street W., has been awarded to Anglin's Ltd., 65 Victoria Street, and electrical work to the Electrical Repair & Contracting Company, Ltd., 317 Craig Street W. Tenders are being received for roofing and mill work.

The contract for roofing, heating and plumbing in connection with the flats in course of erection for Z. Corbeil & Frere, 3 Desjardins Avenue, has been let to J. Belisle & Frere, 808c Papineau Avenue. Carpentry by general contractor.

In connection with the residence which is being built on Durocher Street for Victor Guertin, 31 Sherbrooke Street W., the contract for plastering has been let to H. Pepin, 2 Gauthier Street.

Niagara Falls, Ont.
Humphries & Clemens have commenced the erection of a residence on South Street for A. M. Elkins, 61 Amoury Avenue. Frame and brick construction. Estimated cost, $3,100. Contracts will be let for plumbing, heating and electrical work.

In connection with the bungalow which is being built on McRae Street by William Henry, Second Street, the plumbing has been let to William Crawford, Buckley Avenue, and the electrical work to the Carter Electric Company, Erie Avenue.

Work has been started on the erection of a residence for Rev. O. C. Gray, 314 Victoria Avenue. The general contract has been awarded to W. Henry, Second Street, the plumbing to William Crawford, Buckley Avenue, and the electrical work to the Carter Electric Company, Erie Avenue. Brick veneer and shingle construction. Estimated cost, $3,500.

Ottawa, Ont.
The Oakland Land Company, Sparks Street, have commenced the erection of a residence on Sparks Street. The contract for masonry has been let to F. Dougherty, Ottawa South, the plastering to James Bowman, 239 Florence Street, painting to Ritchie & Nunn, Sunnyside Avenue, heating to the Pease Foundry Company, Lyon Street, and plumbing to Gervin & Lillico, Bank Street.

In connection with the residence being guilt on Ossington Street by W. H. Lee, Billings Bridge, Ottawa, the contract for plumbing has been awarded to Gervin & Lillico, Bank Street, and the electrical work to Dominion Electric Company, 344 Sparks Street.

Peterborough, Ont.
The contract for electrical work required at the residence which is being

built at Homewood and Belmont Streets for A. W. Cressman, 212 Brock Street, has been let to Alexander & Miller, George Street.

Quebec, Que.
In connection with the erection of a residence on St. Gabriel Street for L. R. Demer,s 407 St. John Street, the contract for roofing, heating, plumbing and electrical work has been let to P. Paradis, 236 D'Aguillon Street, and the painting to Pelchat & Aubin, 12 Bayard Street. Plastering by the general contractor.

The contract for roofing in connection with the residence which is being built on Eighth Street by W. Bouchard, 18 Second Avenue, Limoilou, has been awarded to N. Barbeau, Bridge Street. Sub-contracts will also be let for brick work and plastering.

In connection with the residence which is being erected on Cartier Avenue by Chrysante Jobin, 198 Lockwell Street, the contract for roofing, heating, plumbing and electrical work has been let to P. Paradis, 236 D'Aguillon Street, and the painting to Pelchat & Aubin, 182 Bayard Street. Masonry, carpentry and plastering by owner.

J. B. Verret & Son, 184 Third Avenue, have commenced the erection of a residence on Begin Avenue for G. Lambert, 296 Cyrille Street. Brick construction, stone foundation, felt and gravel roofing. Approximate cost, $7,000.

Toronto, Ont.
In connection with the residences in course of erection at Queen Street and Neville Park Boulevard for C. R. Munro, 15 Toronto Street, the contract for plumbing has been let to E. E. Restall, 90 Scarboro Road, the heating to Balmy Beach Hardware Company, 2252 Queen Street E., and the painting to H. Blumson, 90 Willow Avenue.

Power Plants, Electricity and Telephones

Bagotville, Que.
A by-law to authorize the construction of an electric lighting system at an approximate cost of $7,000 will be submitted to the ratepayers on December 27th. Village Secretary, A. Potvin.

Grand 'Mere, Que.
Louis Berube, Secretary to the Town Council, will receive tenders until 4 p. m., January 5th, for the supply of electrical equipment, including one 500 h.p. turbine, one generator with exciters, six transformers, two switchboards and wiring. Plans, etc., with Secretary.

Gravenhurst, Ont.
The Town Council will submit a by-law at the January elections to authorize changes to the street lighting system. Clerk, W. H. Butterworth. Approximate cost, $3,500.

Komoka, Ont.
The Lobo Township Council will submit a by-law to the ratepayers on January 3rd to authorize the borrowing of $4,000 for the construction of a hydro electric system. Clerk, E. R. Barclay, Poplar Hill, Ont.

Lobo Township, Ont.
Plans are being prepared for the installation of a hydro power distribution system for the Township Council. A by-law to authorie the construction will be voted on shortly. Approximate cost, $7,000. Clerk, E. R. Barclay, Komoka.

Melford, Sask.
The Town Council propose to purchase one 240 h.p. oil engine for the electric light station. Particualrs from Councillor Mansell.

Sherbrooke, Que.
The City Council will shortly call for tenders on general repairs and improvements to the power plant. Plans are also being prepared for renewal of the transmission lines. Consulting Engineer M. A. Sammett, 301 McGill Building, Montreal.

Springfield, Ont.
A by-law will be submitted by the Town Council on December 9th to provide for the installation of an electric plant at an approximate cost of $5,000. Clerk, J. S. Lucas.

Watford, Ont.
The Town Council will have plans prepared immediately for the construction of a hydro system, and will submit a by-law to the ratepayers in January. Clerk, W. S. Fuller. Estimated cost, $10,000.

Windsor, Ont.
A by-law has been passed authorizing the construction of extensions to the hydro electric system at an approximate cost of $50,000. Material will be purchased by Superintendent O. M. Perry.

Fires

Aylmer, Que.
Fire has destroyed the premises owned by George Pellatt, Main Street. Loss $3,500. Owner will rebuild.

Bluevale, Ont.
Fire has destroyed the barn owned by David Miller.

Brockville, Ont.
Fire has totally destroyed a barn owned by A. Harper, Ormond Street.

Buckhorn, Ont.
W. N. Blewitt's saw and planing mill has been entirely destroyed by fire. Loss, $4,000, partially covered by insurance.

Cocagne River, N. B.
The residence of A. A. Goguen has been totally destroyed by fire. Loss, about $2,000, partly covered by insurance.

Collingwood, Ont.
The residence on St. Peter Street, owned by Robert Wetherup, has been totally destroyed by fire. Loss partly insured.

Derby, N.B.
Fire has entirely destroyed a barn owned by William Bell.

Fairbank, Ont.
Fire has destroyed the residences owned by Mrs. H. Munn, 104 Seneca Avenue, and J. Snow, 102 Seneca Avenue. Loss, $2,600, partly insured.

Halifax, N.S.
Fire has destroyed the business premises at Granville and Sackville Streets, owned by Albert P. Downey, 244 Robie Street. Loss, $6,000, covered by insurance.

Kincardine, Ont.
The residence of E. . Barton, Durham Street, has been destroyed by fire. Loss, $2,500. Owner is considering rebuilding.

Latuque, Que.
Fire has destroyed the residence of Welley Grenon. Loss is covered by insurance.

London, Ont.
The premises of Johnston & Murray, 198 Dundas Street, have been badly damaged by fire. Loss on building and contents, $5,000, covered by insurance.

Lunenburg, N.S.
The foundry owned by Leonard G. Holder has been completely destroyed by fire.

Mitchell, Ont.
Fire has destroyed the barns owned by Thomas Bannon, Tenth Line, Logan.

A business block on Main Street, owned by Dr. Burritt, has been destroyed by fire. Owner will rebuild at once.

Ottawa, Ont.
The engraving plant of the Pritchard & Andrews Engraving Company, 269 Sparks Street, has been damaged by fire to the extent of about $3,000. Loss is covered by insurance.

St. Boniface, Man.
Fire has totally destroyed a business block at Provencher and Tache Streets, owned by L. J. Collins, grocer. Loss on building, $10,000, partially insured.

Miscellaneous

Kingston, Ont.
The Kingston Construction Company, Brock Street, are in the market for the following supplies:—cement, steel, metal sash, frosted plate glass, water tower.

J. M. Caines, contractor, Albion Hotel, desires to receive prices and other information with references to galvanized siding and roofing, horse box mangers, windows, felt or paper roofing.

Niagara Falls, Ont.
J. E. Gardner, 10 Morrison Street, contemplates the purchase of one internal combustion engine, 50 h.p. or higher, for the operation of a hardwood sawmill.

Petrolia, Ont.
J. D. Noble, Blind Line, intends to rebuild his pumping rigs, which were recently destroyed by fire.

Unionville, Ont.
H. H. Powers, is in the market for one 40-foot derrick, with or without power, and one four to six hourse power gasoline engine.

Winnipeg, Man.
Tenders will be received until noon, December 29th, by S. H. Reynolds, Chairman of the Greater Winnipeg Water District, 901 Boyd Building, on the supply of twenty automatic air dump cars and one steam-operated dragline excavator. Plans and specifications at office of the District.

Tenders will be received until noon, December 27th, by the Commissioners of Greater Winnipeg Water District, 901 Boyd Building, for the supply of six two-way dump cars. Specifications at office of the District.

CONTRACTS AWARDED

Sarnia Township, Ont.
Charles Foster, Milner Farm, London Road, Mandamin, Ont., has let the contract for drilling oil wells to David Wright and William Bedal.

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Is it Sound Business to Condemn Our $50,000 Report Without Reading?

COMPARATIVELY little light has been thrown on the Toronto Hydro by-law and its relation to the Harris-Gaby-Cousins report during the past week. Sir Adam Beck in his recent address to the Toronto Board of Trade gave a very interesting outline of the work of his Commission but did not discuss any details of the proposed Hydro radial entrance into Toronto. He tactfully avoided any reference to the other transportation scheme at present before the city council and, indeed, one might almost suppose that the Semi-Rapid Transit Report had not been brought to Sir Adam's attention.

While omitting any discussion of the fact that the Hydro by-law and the Harris-Gaby-Cousins report cover practically the same ground and provide two terminals in the centre of Toronto where only one is needed, Sir Adam did, however, recognize the Contract Record's other contention that the electors would, on January 1, be voting on a question they know practically nothing about. However, his solution is easy—"Trust your Hydro Commission." He asks us to believe that this Commission could not and would not dream of doing anything that could turn out to be an error of judgment. "If we do," he adds, "you have your remedy—turn us out of power." This is a fine argument for a politician, but useless to a business man. If Toronto votes $4,200,000 for Hydro radials, and they turn out to be something different from what we need, what satisfaction or remedy will it be to depose Sir Adam or his colleagues?

Sir Adam's advice regarding this by-law is surely most unbusinesslike. He says "Trust us"; "We have never yet made a mistake (according to our own judgment)"; "This scheme has been worked out by Hydro engineers and **must** be right"; "If it does not work out right, just turn us out of office (after we've spent your $4,200,000 and caused your $50,000 report to be shelved)."

Neither Sir Adam nor anyone else has added one little ray of daylight. The situation has not been improved or changed one iota. There are still two conflicting schemes under consideration, the adoption of either of which in its entirety nullifies the other. Superior engineering skill cannot be argued for the Beck by-law, since Mr. Gaby had a hand in the preparation of both. Haven't the engineers who prepared the Semi-Rapid Report just as much right to say to the people, "Trust our judgment," as have the Hydro engineers? Yet Sir Adam asks us to ignore the report and stake our all on his scheme.

Again we wish to point out that we do not criticize the Hydro by-law in itself. We simply urge the right of the qualified citizens of Toronto to examine and compare before we spend our good money—we urge the wisdom of looking before we leap. We urge the council to consider that the acceptance of the Beck by-law will mean a rejection of the Report. Are our City Councillors ready to place themselves on record as deliberately throwing away $50,000 of the people's money on a report which is condemned without being read?

Good Roads Congress

During the days December 14 to 17 an international road congress was held at Worcester, Mass. This state is one of the most advanced in highway construction on the continent and the convention was held there because of the very general interest which is felt in this work throughout the state. The attendance was somewhat interfered with owing to a heavy snow storm which tied up the railways throughout the state but, in spite of this, the attendance was anywhere from eight hundred to a thousand. In connection with the convention there was held an exhibition of machinery and material.

A number of exceptionally interesting papers were read including the following by prominent Canadian engineers:—"The Development of Highways in Canada and What it Means to the Dominion," by Mr. W. A. McLean, Provincial Engineer of Highways for Province of Ontario; "Precautions Adopted by Can-

(Continued on page 1318)

Grade Separation, Yonge St., Toronto

Main section of larger scheme, covering elevation of steam railway tracks across North Toronto streets from Yonge to West Toronto, well advanced

THE Yonge Street section of the North Toronto grade separation has been completed as far as the subway and the separation of the grades are concerned, and the new C. P. R. station which is being built in conjunction with the grade separation is expected to be finished and ready for occupation by the early summer of 1916.

The plan for a grade separation at this point dates back as far as 1883, when an order was issued for the C. P. R. to break the grades at Yonge Street, by diverting the street traffic under the tracks or by means of a subway. In 1884, before this had been carried out, another order, after further consideration, was issued for an overhead bridge for street traffic. Neither order was carried out, the city and the railway agreeing on the use of gates for the time being. These gates were in operation for years. In 1910 the Railway Board ordered the grades separated by subway. But for various reasons, especially the litigation on the widening of Yonge Street, the work was delayed until the spring of 1915, when operations began in full force. The grade separation was carried out entirely by the C. P. R. Company with the exception of that work directly related to public utilities, which was done by the city and the represented companies.

Subway

Fig. 2 shows a general plan and sectional elevations of the whole project. Originally the gradient of the C. P. R. tracks was about five-tenths of one per cent. down-grade towards Yonge Street from Summerhill Avenue on the east, and a similar up-grade from Yonge Street to West Toronto. The first work was to provide temporary accommodation for the railway traffic. A two-track wooden trestle (Fig. 6) was built, with the exception of two spans over the C. P. R. driveway, where plate girders were used, supported on pile towers. This trestle was built at such an elevation that the track grade was increased to five-tenths of one per cent. up-grade towards Yonge Street on the east and kept level by earth fill and numerous overhead crossings as far as West Toronto. This gave such considerable head-room that the street depression required was correspondingly fairly small. A maximum depth of about 9 ft.

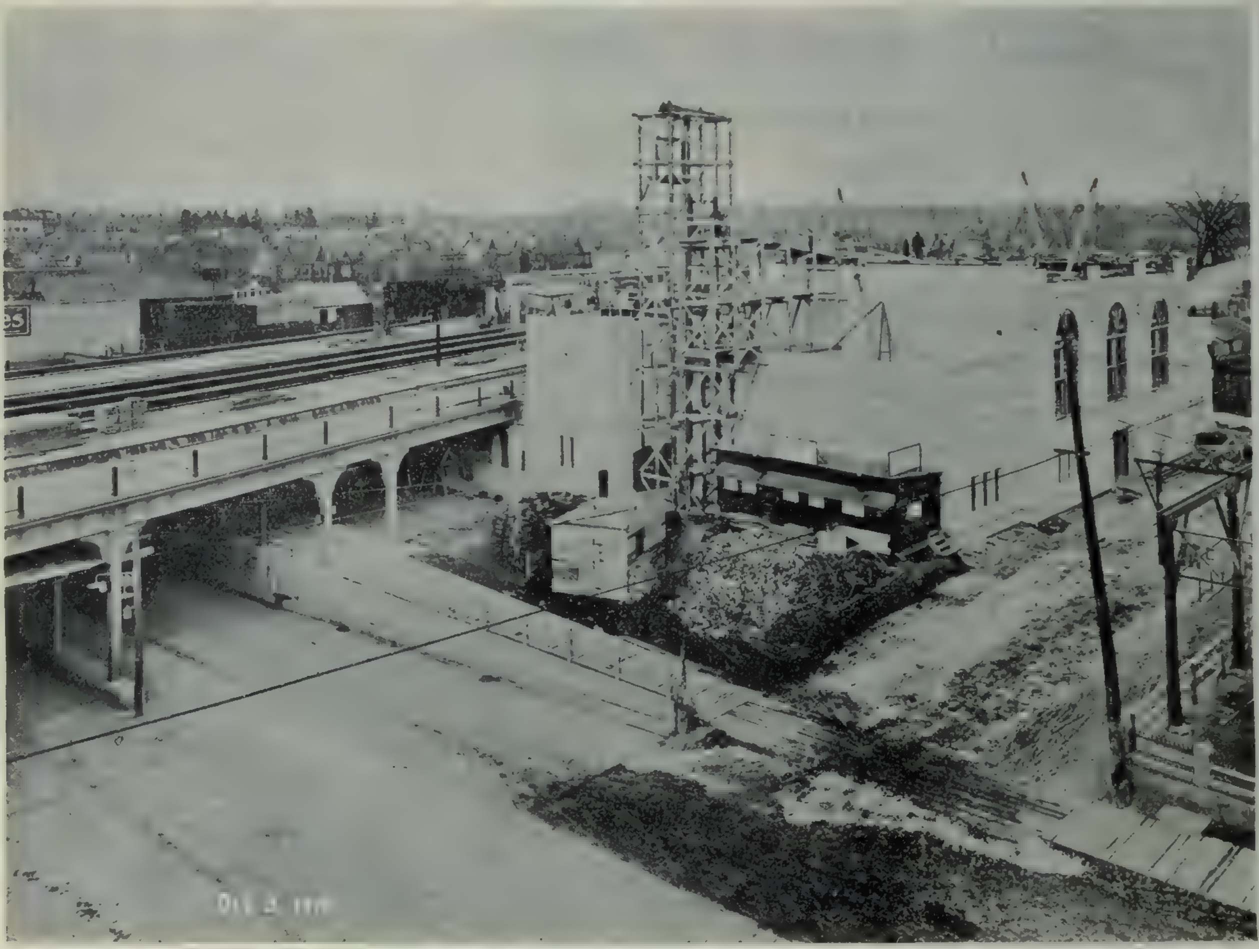

Fig. 1.—Bird's eye view showing general layout, Yonge Street drives, East sidewalk and C.P.R. driveway, station and 135 ft. tower under construction, track and passenger platforms.

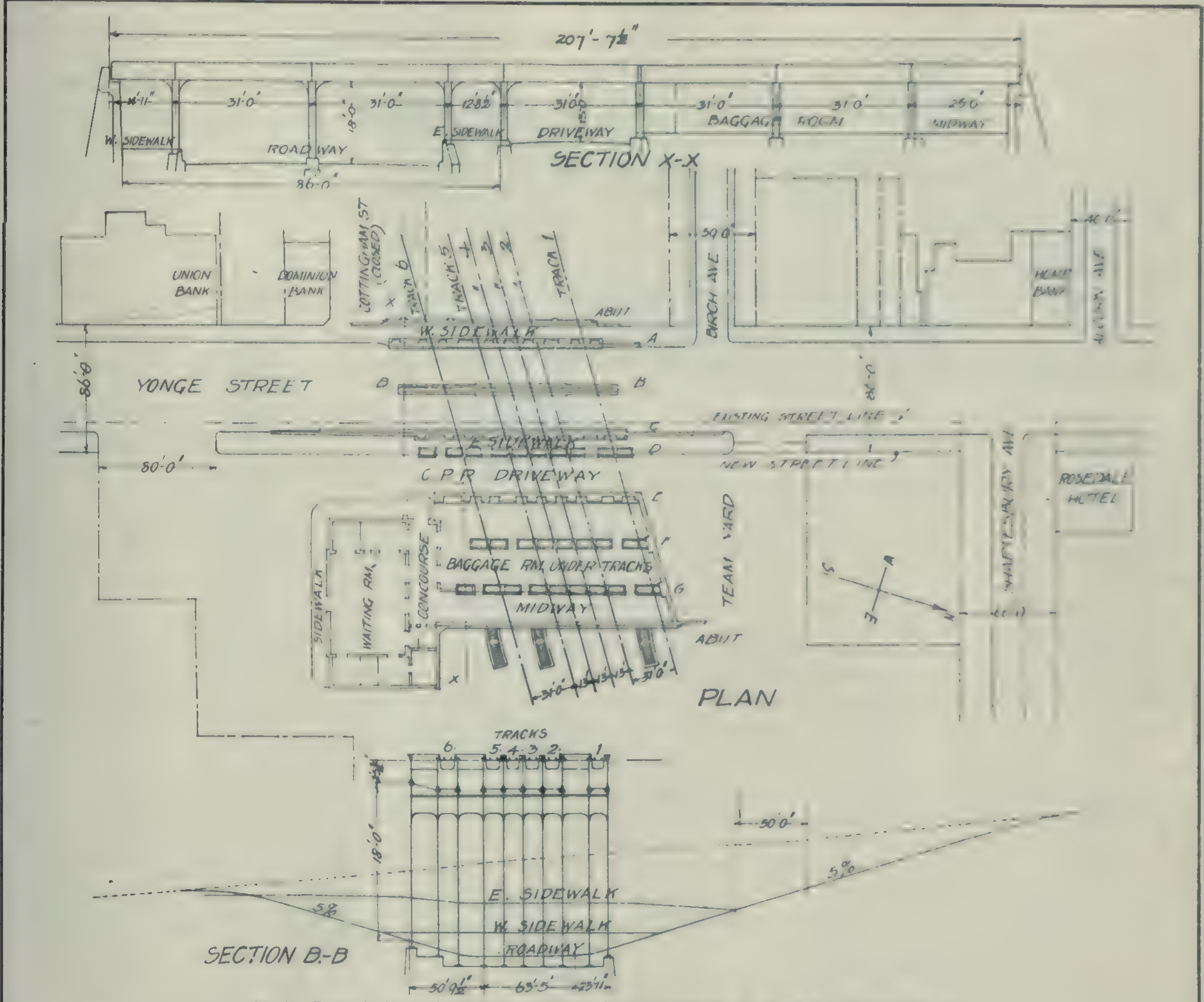

Fig. 2.—General plan and sectional elevation—Grade separation at Yonge St., North Toronto.

was taken out directly beneath the subway; thereby allowing head-room of 18 ft. (Fig. 7).

During construction the civilian traffic was diverted from side to side of the street as work progressed, at one time was even taken around the outside of the west abutment. The vehicular traffic was accommodated by a temporary roadway, which was also shifted back and forth as the excavation was carried on.

The approaches to the subway commence, on the north, at the intersection of Alcorn Avenue on Yonge Street—a distance of about 370 ft. from the centre of the subway, and on the south directly in front of the main door of the Union Bank—approximately 200 ft. from the centre of the subway. Both approaches are uniform grades of five per cent.

The subway is 207 ft. 7½ ins. face to face of ballast walls, 135 ft. 8 ins. between outside columns, and is built of reinforced concrete and steel work with mass concrete foundations. Yonge Street is 86 ft. wide under the subway, having been widened 20 ft. by extending it to the east, and has two sidewalks and two driveways with rows of steel columns which support the track system, between them. The east sidewalk is 3 ft. higher than the west one, which in turn is 2 ft. 6 ins. above the elevation of the driveway.

In connection with the subway is a private drive for the C. P. R. Co., 28 ft. wide, under the tracks just east of Yonge Street, (Fig. 1) for the use of vehicles, etc., going to the station and the baggage room. The baggage room is directly under the tracks, with access to the private drive on the west and to a team drive on the north.

Track Floor System

The track floor system over the street consists of two main tracks for freight, four tracks for passenger traffic, and three passenger platforms. These platforms will be covered with steel-supported umbrella roofs. Access to the platforms is made by means of three stairways descending to a midway which connects directly with a concourse in the station which in turn opens into the main waiting room by large doors and into a vestibule under the tower in the north-west corner of the station.

One of the special features in the construction of the subway is the design of the track slab (see Fig. 4). The tracks are carried on floor slabs which are built entirely of reinforced concrete supported by girders

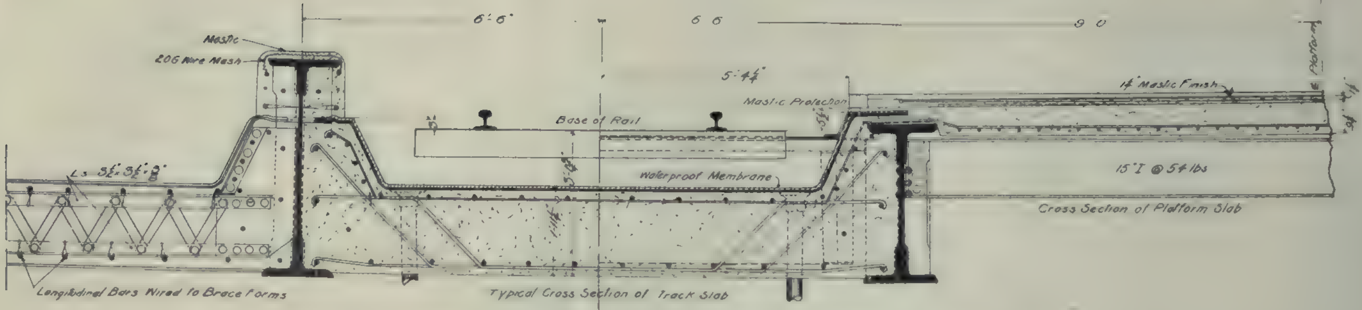

Fig. 3.—Special design of track slab—Section at left shows reinforcing bars.

also well massed in concrete, the whole structure being borne on steel columns. The reinforcing consists of an intricate system of bars and rods so placed as to brace each other (see Figs. 3 and 8). There is between fifty and sixty miles of reinforcing steel used in the slabs; no I-beams are used. The design of these track slabs is something new, being introduced for the first time by the C. P. R. Co. engineers in this subway. It reduces very considerably the noise of passing trains, as well as being a very desirable floor system.

The detail specifications of these floor slabs call for plain round bars or square bars of equivalent section, with an ultimate tensile strength (T) of 55,000 to 70,000 lbs. per square inch, a minimum yielding point of 33,000 lbs. per square inch, and a minimum elongation of 1,250,000/T per cent. in 8 inches.

An expansion joint is placed at Bent E on the track floor (see Fig. 4).

The tracks are carried on cross ties embedded in ballast laid on the track slab, the face of the slab being covered with a waterproof membrane to prevent leakage into the baggage room and midway directly below the tracks (Fig. 9). The level of the tracks is 5 inches lower than that of the platforms (see Fig. 2).

Baggage Room

The baggage room, as already stated, is situated under the tracks between the C. P. R. driveway and the east abutment of the subway (Fig. 10). It occupies the whole width of the subway, utilizing the track and passenger platforms for a ceiling. It is 62 ft. wide by 135 ft. long approximately, with four entrances off the team yard on the north and five off the private driveway on the west; and opens through a checking office into the concourse of the station (Fig. 5). The walls of the baggage room are of reinforced concrete; the floors are concrete base with mastic cover, the whole being laid on cinder fill. Baggage and express will be elevated to the platforms for the respective trains by means of three hydraulic lift elevators—one for each platform.

Drainage System

Due to the presence of the station building, the form of the track platforms, the use of umbrella roofs over the passenger platforms, and the water basin formed by the street depression, a very complete water and drainage system is necessary. The company have laid their own drainage system and connected it with the main city sewer which passes underneath the western drive. Twelve-inch trunk mains—one on the north and one on the south—carry the run-off, seepage, and station drainage to the city sewer. Nine-inch mains under the baggage room take the run-off from the roofs and track slabs by

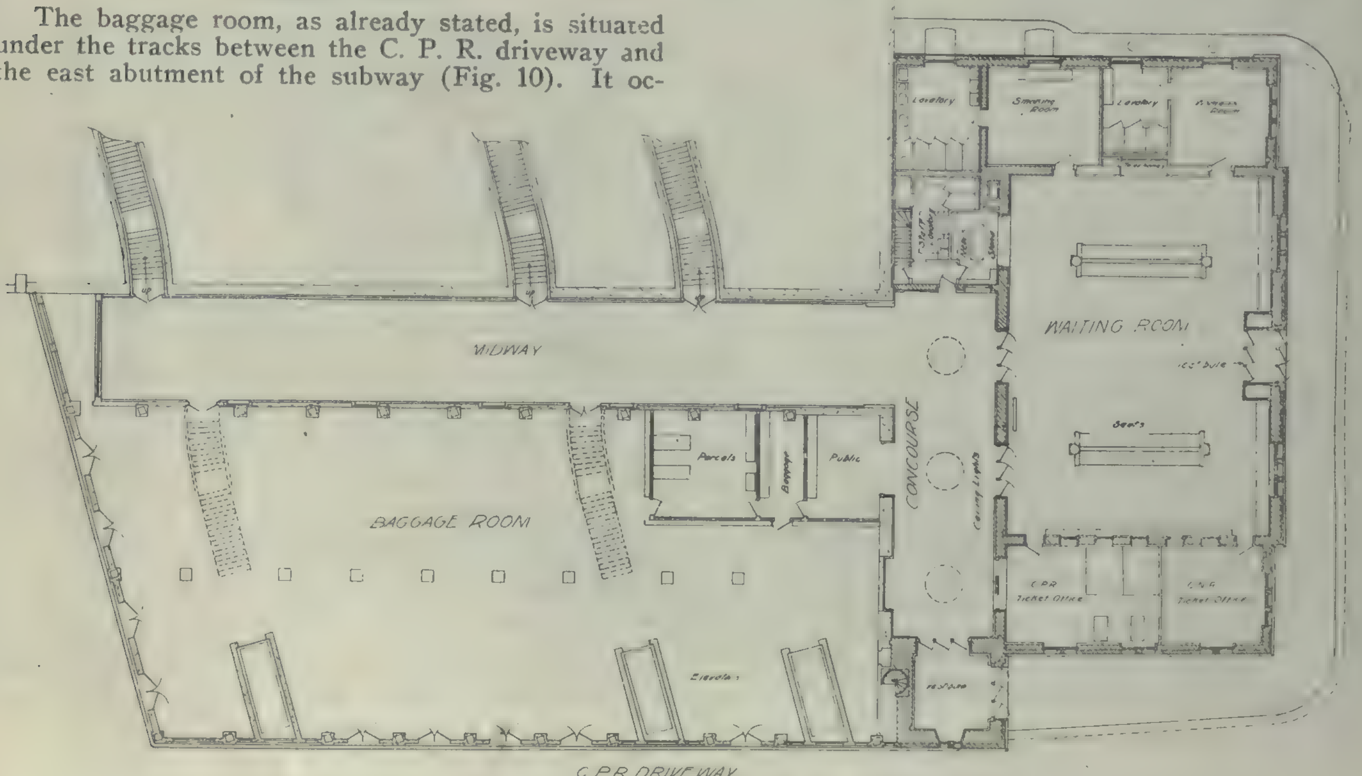

Fig. 4.—General plan of baggage room and station house, North Toronto grade separation.

means of down-pipes, which run down the supporting columns through the floor, into the 12-in. mains. Another 9-in. main is laid along the west side of the east abutment under the midway floor to look after the weepage under the eastern abutment. A layer of stones is piled along the east side at the foot of the abutment to allow the water to get into the drain-pipes. No pumps were necessary in the sewerage system to keep up the flow, due to depressing the street; Yonge Street has a decided drop just south of the subway, and the sewer is depressed through the hill to give it a uniform slope.

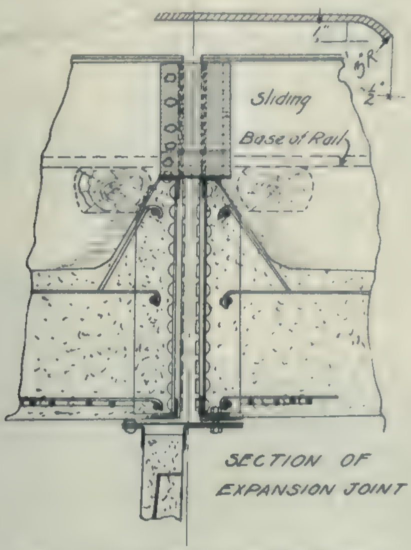

Fig. 5.—Cross-section of expansion joint.

Underground Work

On depressing the grade under the subway the following public utilities had to lower their systems to the new grade: under the west sidewalk, the Toronto Hydro-Electric and Toronto Electric Light; under the drive, reading consecutively from the west, the city waterpipe, sewer, Consumers' Gas, Bell Telephone, water, Consumers' Gas, and, under the east sidewalk, C. P. R. Telegraph. Each utility did its own work, the different cables, pipes, lines, etc., having to be lowered about 9 ft.

Constructional Operations

Excavation for subway and approaches was done with two steam shovels, the material being teamed away. The fill for raising the grade of the railroad was brought up on the company's flat cars and dumped through the trestle work. For the subway and the baggage room the concrete was mixed by two cement mixers, wheeled in buggies, and poured into chutes leading to the forms.

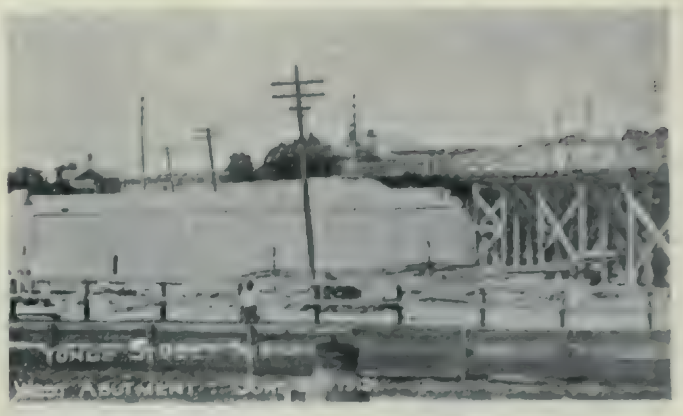

Fig. 6.—Showing west abutment and temporary wooden trestle for railway traffic.

For all mass concrete, underground, and monolithic work, concrete was mixed in the proportion 1:3:5, Canada cement being used. During the summer, when constructional operations were at their height, about 400 men were employed by the different contractors, utilities, and the city. The concrete construction, with the exception of some interior work is practically finished; concreting during frosty weather is carried on by enclosing the work and heating by a steam pipe, removing frost from the aggregate by the use of steam, and if necessary using heated water.

Material

Approximately 345,000 lbs. of reinforced steel, equivalent to fifty or sixty miles in length, has been used in the slab construction, with 1,500,000 lbs. of structural steel in girders in the subway. There are 200,000 cu. yds. of reinforced concrete in track slabs, 500 cu. yards of reinforced concrete in platform slabs, and in the piers, pedestals, abutments, etc., 4,000 cu. yds. of mass concrete, with 150,000 lbs. of reinforcing steel. Excavations for the subway and approaches amounted to 25,000 cu. yds.

Station House

The station house (see Fig. 1) is situated on the east of the C. P. R. driveway to the south of the

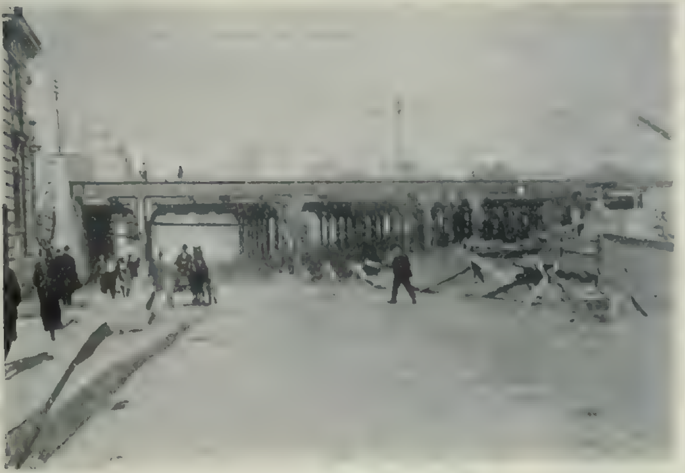

Fig. 7.—South approach to subway—showing drives and sidewalks—Heavy girders used in track platform.

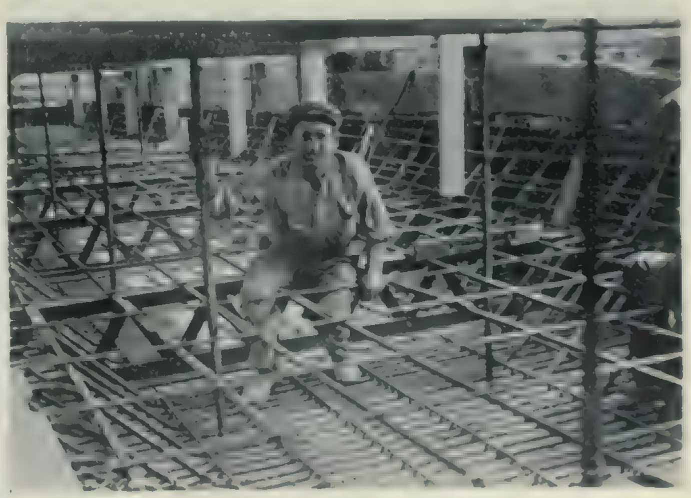

Fig. 8.—Special design in track slabs—Placing the reinforcing steel bars.

tracks, with the main entrance on the south and the second entrance through a tower in the northwest corner of the building. The station is a one-storey structure 75 ft. wide and 115 ft. long. Off the main waiting-room, which is 50 by 72 ft., are the C. P. R. and C. N. R. ticket offices on the west side, women's waiting-room, smoking room, telephone booths, and lavatories on the east, a news-stand in the north-east corner, and on the north a spacious concourse which opens into a vestibule under the tower, the baggage room, and a midway which leads by stairs to the tracks. This concourse will be brilliantly lighted by three large cluster ceiling lights.

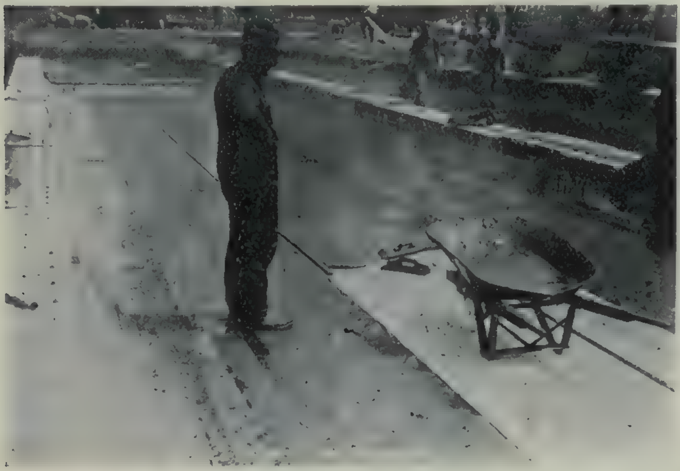
Fig. 9.—Placing the waterproofing membrane on the track floor.

While the station is not very large, there is excellent accommodation for a large number of people on account of the direct facilities for reaching and leaving trains. People arriving at the station may enter either by the south or west doors, pass through the concourse directly into the midway, and by the proper stair-way reach their train. Or, vice versa, people leaving trains pass down the stairs through the midway and concourse, and directly out by either vestibule. There is no interruption due to trains blocking the passenger's path, and there is also no necessity for passengers to cross tracks; all trains being directly accessible from some one of the three platforms.

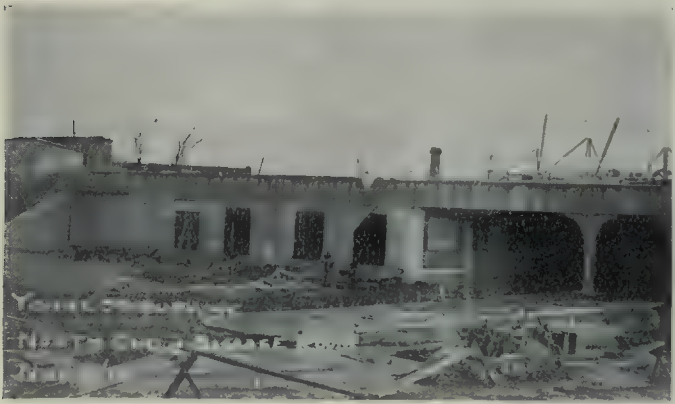
Fig. 10.—Showing east abutment, north end of baggage room, and C.P.R. private drive.

In the north-west corner of the station building is a square tower 135 ft. high with a clock having four faces, which should, on account of its altitude, be seen for a long distance. The station is built with Tyndall limestone from the Wallace Sandstone Quarries, Manitoba. This is a very beautiful cut stone with a fossil mark showing on the surface, and has been used for the first time in Toronto in this building. The walls are brick-lined, while the floor and roof are built of terra-cotta and are wall-bearing. The interior finish of the station will be somewhat similar to that of the C. P. R. building at the corner of King and Yonge Streets, Toronto. The station house has been closed in, the tower is expected to be finished by the middle of February, and the whole building completed and ready for occupation by the middle of next summer.

Contractors

The C. P. R. engineers are supervising all the work, with sub-contracts let as follows: Wells & Gray, concrete, excavations, subway and baggage room; Dominion Bridge Company, Limited, superstructure and steel work; Peter Lyall & Son, station building; the different public utilities did their own work on underground changes.

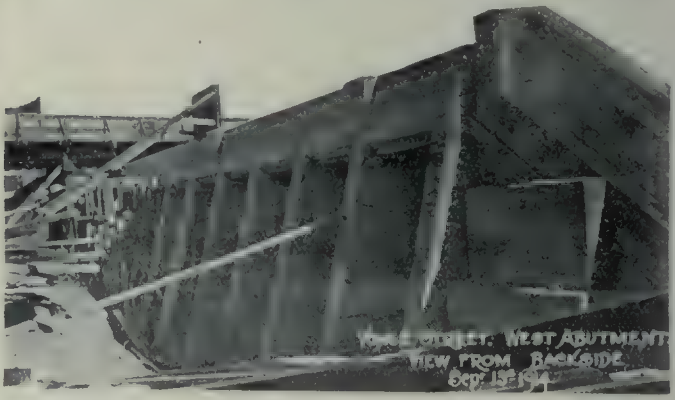

Fig. 11.—West abutment from behind—Heavy mass concrete construction.

Our First Business "Terminate the War"

Fifty-two of the staff of the Canadian Fairbanks Morse Company, Limited, have joined the overseas forces. Montreal has sent 15; Toronto 7; St. John 8; Winnipeg 10; Calgary 2, and Vancouver 10. Mr. Graham Drinkwater, vice-president, states that the company will keep open the positions of those enlisting, and adds: "We believe every Canadian business man should realize that the first business of this country is to help terminate this war, and this can only be done by sending our men, giving our money, and helping the great cause in every possible way open to us."

Good Roads Congress

(Continued from page 1313)

adian Cities Against Extreme Climatic Changes in Buildings and in Maintaining the Streets," by Controller Cote of Montreal; "Canada as a Country for Motorists and the Quebec Highway System," by Mr. U. H. Dandurand, Honorary President of the Dominion Good Roads Association. Other Canadian representatives were Mr. J. W. Levesque, M. L. A., Montreal, and Mr. G. A. McNamee, Secretary of the Dominion Good Roads Association.

Adaptability of Unit Construction

Under favorable conditions unit construction has proven itself greatly superior to the usual or monolithic type.

By J. E. Conzelman[*]

THE past few years have witnessed a remarkable development in the art of reinforced concrete construction. Improved methods of mixing and distributing the concrete, simple and practical form details, and the general efficiency which comes with long practice, have effected economies of time and expense. Unit methods have shared in this forward movement and now hold their place among the recognized standard forms of construction.

During the past six years unit methods have been successfully applied to the construction of various types of reinforced concrete structures, and the practicability and adaptability of the methods have been thoroughly demonstrated. Under conditions favorable to its use, unit construction has proven itself greatly superior to the usual or monolithic type, and its adoption has resulted in economy, simplicity of construction, and an opportunity for better workmanship.

Considerable interest has lately been manifested in the use of unit methods for the construction of viaducts, and structures carrying elevated railways. There is no doubt that this method will be successfully applied to such structures consisting of a combination of structural steel and concrete, as well as to all-concrete designs.

The Railroad Field

Railroad work offers a wonderful field for the development of the unit idea. A standardization of such structures as engine houses, freight sheds, snow sheds, track shelters, etc., could be made to result in very great economies by the adoption of this method and the establishment of centrally located factories for the manufacture of the units. The amount of work that could be accomplished in this time by a small force working regularly would be surprising, and the cost, if permanent forms were used, would be exceedingly low. A shop proposition would also permit the use of lighter sections, because factory concrete has greater strength and is a more reliable product than the "hit and miss" concrete of the ordinary construction. By careful methods there is no doubt but that thirty or forty per cent. of the concrete ordinarily used could be saved. Buildings would be carried in stock, as are other commodities, and could be wrapped up and sent out on short notice and erected in a surprisingly quick time. What is true of railroad structures applies with equal force to any development consisting of similar units such as terminal buildings or manufacturing centres similar to the Bush Terminals in New York.

It may be interesting to you to know that some of the railroads have made progress along this line; the Santa Fe has assigned engineers to this task. It is hoped that the offence will be forgiven if this occasion is used to call attention to one of the phases of usual construction methods that needs correction, namely, the haste with which the concrete materials are put through the mixer. Engineers as well as contractors seem to be hypnotized by the American habit of doing things on a large scale and in the shortest possible time, and perhaps without due regard to excellence and uniformity of product. We want a batch a minute, a floor a week, ten floors in ten weeks, and arrange our plans accordingly. It was recently reported in one of the engineering journals that on a large contract an average of 70 batches an hour was frequently maintained.

Can you imagine that the materials for a yard of concrete can develop the close intimacy necessary for a uniformly strong concrete in the ten or twenty seconds they are allowed after their introduction in the mixer?

The result of these methods is the production of a concrete of mediocre strength and of uncertain quality. As a consequence, it follows that more concrete materials are required than would be used if the materials were properly mixed. Recent experiments show that the strength of concrete can be greatly increased by long and thorough mixing, and it is no doubt true that better construction methods would result in a saving of as much as twenty per cent. of the concrete materials without reduction in strength.

A part of this trouble is due to the methods necessarily used in the construction of the ordinary concrete building. After a week or two of carpenter work the forms for one floor are prepared, then comes "The Day," and all energies are bent to pour the entire floor in one day of concreting. The mixer works about one day out of six and has to do the mixing in one-sixth of the time that should be allowed.

Unit methods give opportunities for making better concrete. A reasonable amount is poured each day, which gives time for thorough mixing, and the concrete is poured into individual forms in comparatively small quantities so that each batch is inspected and puddled. When the time comes, as it soon will, when units are made in permanent factories, by improved processes of manufacture and curing, a perfectly reliable structural material will be obtained, and perhaps fifty per cent. of the concrete that is now used will be saved.

Cedars Rapids

I will describe the construction of the buildings. There are 6,000 cubic yards of unit work and 3,000 cubic yards of monolithic concrete in the two buildings.

The power house as now built is 642 ft. 4 ins. long and 124 ft. 11½ ins. wide over all, and consists of 35 typical bays 16 ft. 8 ins. long and three special bays 18 ft. 4 ins. long; and is arranged to accommodate ten generators, three exciters and ice sluices.

The steel framework was supplied and fabricated by the Phoenix Bridge & Iron Works of Montreal. The roof trusses are designed for a load of 100 lbs. per square foot. The crane girders and columns in the main aisle are designed to carry two 150-ton capacity electrically-operated travelling cranes. The steel work in the gate house is arranged for a thirty-ton capacity crane. The high columns were spliced at the level of the crane girders.

All the exterior walls are twelve inches thick and consist of two independent slabs four inches thick, with an air space between. The steel columns were provided with slots to receive the slabs (which were lowered down from the top of the columns). After two opposite slabs had been set, they were held apart by a piece of one-inch plank which fitted into notches in the slabs. This board also served as a form for the grout which was poured into the space between the columns and the slabs. The purpose of this grout is to hold the slabs in place and also to protect the columns against corrosion. The concrete pilasters were cast in place after the slabs had been erected. The window sills and some of the jambs around the windows were made solid, 12 ins. thick. The doors are of wood covered with copper. The window openings are equipped with rolled steel sash glazed with two thicknesses of double diamond glass, with an air space one-quarter of an inch thick between the lights. The monitor is similarly glazed and the ventilating portions are moved by operators extending down to the level of the main door.

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[*] Ch. Eng. Unit Construction Co., before Engineers Club of St. Louis.

The roof consists of reinforced concrete slabs or units, supported by steel trusses. The roof units consist of a reinforced concrete plate 3 ins. thick cast integral with these beams, which are carried around the four sides, the entire unit resembling the cover of a box. The units are 16 ft. 6½ ins. long and 16 ins. deep over all; those adjacent to the walls, however, have a special slope. Concrete saddles were formed on the roof for the purpose of directing the water to the downspouts. The roof covering is 4-ply Barrett specification material mopped directly to the concrete. The downspouts are of 18 oz. copper and are brought down inside the building.

Units Provided with Lifting Hooks

Construction was started at the shore or north end of the power house. The structural steel and concrete units were brought to the building on flat cars over a trestle which connected with the high part of the dam. All of the erection was done by means of a structural steel stiff-leg derrick mounted on a triangular steel tower sixty feet high. This high tower and the 84-ft. boom made it possible to complete the erection for the full width and height of the building as the derrick was moved back. The units are provided with lifting hooks or bent steel bars which are imbedded in the concrete when the unit is cast, and which are cut off after the units are in place. The weight of the heaviest steel member was about 5¾ tons; the heaviest unit handled weighing about eight tons.

The cement shed was located along a material track and had a capacity of 5,000 barrels of cement; sand and stone were received in six-yard side dump cars. The concrete materials were wheeled to the mixer and water was taken from the Soulanges Canal by a small steam pump operated from the mixer boiler. The mixer discharged directly into distributing buckets of the controllable discharge type and the buckets were handled by a 15-ton Browning locomotive crane with a fifty-foot boom, operating on the yard track. This track extended the full length of the casting yard (about 400 ft.), and the forms were disposed on each side of the track for a width of 50 ft., allowing a strip 10 ft. wide for the track; the effective area of the casting yard was 36,000 sq. ft. The forms were supported on 4 in. by 4 in. sleepers which were carefully levelled and bedded on the ground. The sides of the roof slab forms were covered with sheet metal to assist in easy withdrawal of the unit from the forms.

Lifting hooks were cast into the units at convenient places and as soon as the concrete had hardened sufficiently the units were raised from the forms by the locomotive crane. They were then, as a general rule, taken to the storage yard for further curing, or were placed on flat cars and taken directly to the building.

The transformer house is constructed entirely of reinforced concrete and is a four-storey building, with basement. The foundations rest on hard clay at a depth of about seven feet below grade and are designed for a load of 4,000 lbs. per sq. ft. The building is 228 ft. long, and comprises ten bays twenty feet long, and four bays seven feet long.

To accommodate the transformers, placed in groups of three near each end of the building, a special column spacing was used. A length of 47 ft. of building was divided into three equal spaces of 15 ft. 8 ins. each instead of the typical spacing of 20 ft. and 7 ft. Above the third floor typical spacing was used and the columns on each side of the 7 ft. bay are carried by reinforced concrete girders.

The roof is designed for a load of 100 lbs. per sq. ft., the upper floors for a live load of 250 lbs. per sq. ft. except where special loading occurs. The ground floor is of very heavy construction and is designed to support the transformers which were estimated to weigh 75 tons, and also to support a standard gauge track, upon which the special track, or car, for handling the transformers, is to be operated. In addition to the live loads specified, all floors were designed for a six-inch concrete finish. The load requirements necessarily resulted in very heavy construction.

The exterior walls consist of concrete slabs 10 ins. thick, with a 2-in. air space in the centre; the air space was formed by means of a sand core, the sand being washed out before the unit was set. The ends of the building are closed with 6-in. tile walls plastered on both sides, so that these walls will be easily removable should the building be extended. The basement walls are 12 ins. thick and are constructed of reinforced concrete, except at the ends of the building, where brick is used. Below grade the walls are tarred and a drain is provided around the building at the footing level to intercept any moisture that may seep in.

On account of the special construction of the ground floor, and because of the lack of duplication, it was decided to construct this floor in the usual way, as well as the extremely high columns which extend about 35 ft. above it.

Erection

A track was laid along the north side of the building, and the units were brought down from the storage yard on flat cars. Two derricks were used for the erection. Derrick No. 1 operated on the ground floor and set the building complete to the level of the third floor as it moved back. As soon as the erection had progressed sufficiently Derrick No. 2 was set up on the third floor. This derrick completed the erection up to the roof level as it moved back. These are stiff leg wood derricks, steam operated, with 75 ft. booms.

To complete the erection the lower derrick was placed on the roof and in this position was used to dismantle Derrick No. 2, and set the remaining units.

All the partitions, with the exception of a six-inch unit wall which extends the full length of the building on the first floor, and some tile and glass partitions around the office, are two-inch solid plaster partitions—cement mortar on metal lath and steel studs. The partitions between the lightning arrester compartments and the transformer stalls are double partitions. The doors to the lightning arrester compartments and those in the partitions on the high tension floors are of wire mesh on steel frames, and are provided with high grade locks.

The roof covering is similar to that of the power house; all metal flashings, except at temporary ends, are of copper. The downspouts are carried down inside the building and are 5-in. wrought iron pipe. The window openings are equipped with rolled steel sash glazed with two thicknesses of glass, as in the power house.

Cotton Handling Plant of the Galveston Cotton Compress and Warehouse Company

The plant of the Galveston Cotton Compress & Warehouse Company consists of a group of one-storey buildings with a floor area of about nine acres. There are 12,000 cubic yards of unit concrete in the buildings, and 1,550 cubic yards of monolithic. There is nothing particularly involved or difficult about the design or construction of these buildings. Attention may be called, however, to the fact that with unit methods the construction of a saw-tooth roof presents practically no more difficulties in construction than a flat one.

Our experience with foundations was interesting and instructive, from both an engineering and ethical side. The site was filled with sand to a depth of perhaps 10 ft., this fill having been pumped in when the general grade of the city was raised and the sea wall constructed. The fill is fine sand with considerable silt, and on account of poor drainage is usually wet and a heavy rain floods the site. Upon receiving notice from the contractor that the ground was not, in his judgment, a proper foundation for the buildings, the architect, a Galveston firm, advised that many buildings had been constructed upon this fill and had shown no settlement, and he ordered the work to proceed.

The foundation for the entire Classing Shed was then poured. This building is 140 ft. wide and 1,070 ft. long, and there are 424 isolated column footings, in addition to the wall footings.

Erection of units was started at the north end, and after six bays—120 feet—of building had been set it was noticed that the foundations were settling and shifting. Erection was stopped and instructions were requested from the architect. He replied that as we had agreed to deliver a plumb and level building it was up to us. After some discussion a reasonable arrangement was made for doing the work, and it was determined to remove the isolated footings, drive three piles under each, and then replace the footing on a thin layer of concrete, capping the piles while this concrete was yet soft. This plan proved successful. A piledriver, arranged with a boom for lifting the footings, was mounted on a wide gauge truck. This outfit operated on rails and moved transversely over a line of footings, removing the footings and driving the piles as it progressed. The footings were replaced by the erection derrick.

These buildings have recently passed through the severe storm experienced at Galveston, without any injury or settlement, although the site was covered with five feet of water.

It was first thought that a box of tight sheet piling driven around the perimeter of the footings to a depth of 6 feet, would confine the sand and transmit the load to a lower strata. A test, however, showed considerable settlement and tilting. The footing areas were originally determined by an allowed soil pressure of 1,500 lbs. per square foot.

The lesson to be learned from the ethical side of this experience is that prevailing methods of writing contracts needs correction. The contractor necessarily assumes considerable risk when he undertakes a contract and he should be protected against unscrupulous owners or architects, and, perhaps, engineers, and given some binding assurance that they will carry out their part of the agreement. In other words, there is just as much reason for the owner and architect to give bond for the faithful performance of their part of the work, as there is for the contractor to do so.

Slippery Pavements

The complaints as to the slippery condition of bituminous surfaced roads, which are necessitated with the onset of winter each year, are again in evidence. Efforts to minimize the difficulty by leaving the surface of the tarmacadam in a roughened condition, and by an improved design of horses' shoes, have been tried, but nothing has come of them. It would appear that the best palliative is to sand the surfaces on the approach of frost. This is, however, a somewhat slow business, and a rotary sand distributor attached to a horse-drawn or motor vehicle is badly required. The Engineer suggests that here is an opportunity for an inventor to devise an apparatus.

The New Park Public School, Toronto

The new Park School, at present only in the preliminary stages of construction, will, when completed, replace one of the oldest public schools in the city of Toronto. The new building will face Sydenham Street, a short distance west from Sumach Street; the present building faces on St. David's Street. When the new building is completed and ready for occupation the old building will be removed and the grounds extended the whole width of the block from Sydenham Street to St. David's Street.

Park School will when completed be the largest public school in Ontario, being three storeys high exclusive of the basement, and containing thirty-seven class-rooms. Two of these class-rooms will be available for the special work of the Domestic Science and Manual Training departments.

The general floor plan (Fig. 2) resembles the letter T inverted, with a main hall running north and south and a long cross corridor running east and west, the class-rooms being situated along either side and at the end of the latter, on the several floors. The main entrance faces the south on Sydenham Street, with a second entrance to the western wing also on Sydenham Street. There are four entrances to the playgrounds—one at each end of the cross corridor and one on either side of the ground-floor hall (Fig. 2). The main entrance landings will be built of New Brunswick brown stone, while the playground entrance will be of concrete. The main entrance consists of three double doors between four large stone columns; general admission being through the outer pair, which open directly into two vestibules. From the vestibules the pupils will pass up concrete steps into the main hall and corridors.

Special accommodation will be provided in the way of a principal's office, with a waiting room attached, placed between the two vestibules, just inside the main entrance; teachers' rooms and teachers' dining-room and kitchen on the Mezzanine floor; medical inspection room, etc. The large kindergarten room on the ground floor will be available for assembly hall purposes in combination with the ground floor hall and corridor space—a plan which has been adopted generally in the Toronto schools.

The class-rooms are in general, all similar in design and equipment, each class-room, including the kindergarten, having its own cloak-room. The building is so designed that every class-room will have at least one side, and in some cases two, open to natural light; but will also be electrically lighted, each class-room to be illuminated by two 500-watt central ceiling lights. The hall, vestibules, and corridors will be lighted by 60-watt ceiling lights placed uniformly throughout. Leaded glass will be used in all windows. The class-rooms, teachers' and principal's rooms, and waiting room will have maple floors, while the vestibule, hall, and corridor floors will be Terrazzo. The heating and ventilation will be by steam, aided by electric fans, fresh air being taken in through two large flues built on either side of the main entrance. The plumbing work, and all sanitation equipment, will be high-class and modern.

The exterior finish will be of brick and Sackville, with New Brunswick brown stone facings and copings.

The sub-contractors are: masonry, H. Lucas & Son; carpentry, D. Springman; plastering, W. J. Haddock & Son; painting, J. R. Bell; plumbing, heating and ventilation, Purdy Mansell, Limited; iron stairs, Canada Wire and Iron Goods Company; roofing, W. E. Dillon & Company; leaded lights, Luxfer Prism Company; reinforced concrete, A. C. Richmond; heat regulators, Johnson Temperature Regulating Company; electric wiring, A. R. Rice & Company; Terrazzo floors, Venetian Marble Mosaic Company.

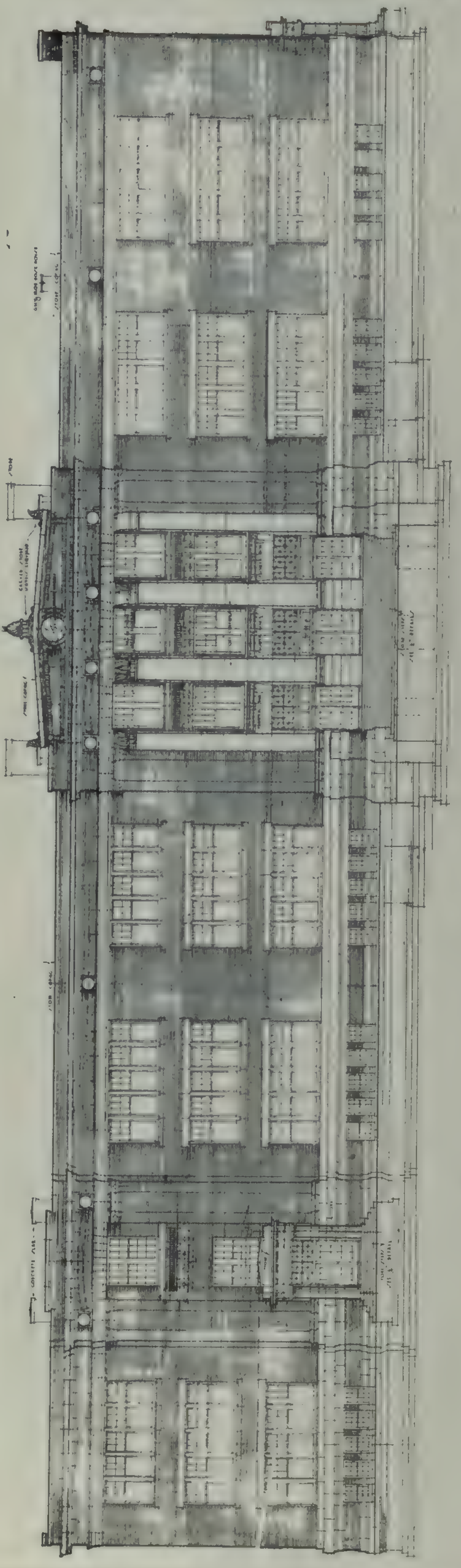


Fig. 2—South Elevation of Park School—Public Main Entrance and Side Entrance face on Sydenham St. just west of Sumach St.—Handsome new brick edifice—Largest public School in Ontario.

Sand versus Mortar Beds for Brick Pavements

By Will P. Blair

No one can question that brick pavements, constructed in accordance with directions which provide for a sand cushion immediately underlying the brick, have shown most satisfactory results. Many examples of such streets show but a slight impairment from any cause, regardless of age or traffic. The faulty ones are the direct result of a departure from a failure to comply with the details of construction generally recognized as essential.

One of the things seldom accomplished is proper compression of the sand cushion. It is so difficult to get it done that many are willing to hazard sufficient resiliency for protection to the pavement by leaving it out altogether. It has one function, and only one—that is, to relieve the shock due to impact in the use of the pavement and to furnish a uniform support to the overlying monolith. A requirement to fill up and roll and refill for at least three times is a necessity in order to obtain a uniform and sufficient support.

I am well aware that mortar beds under the wear-

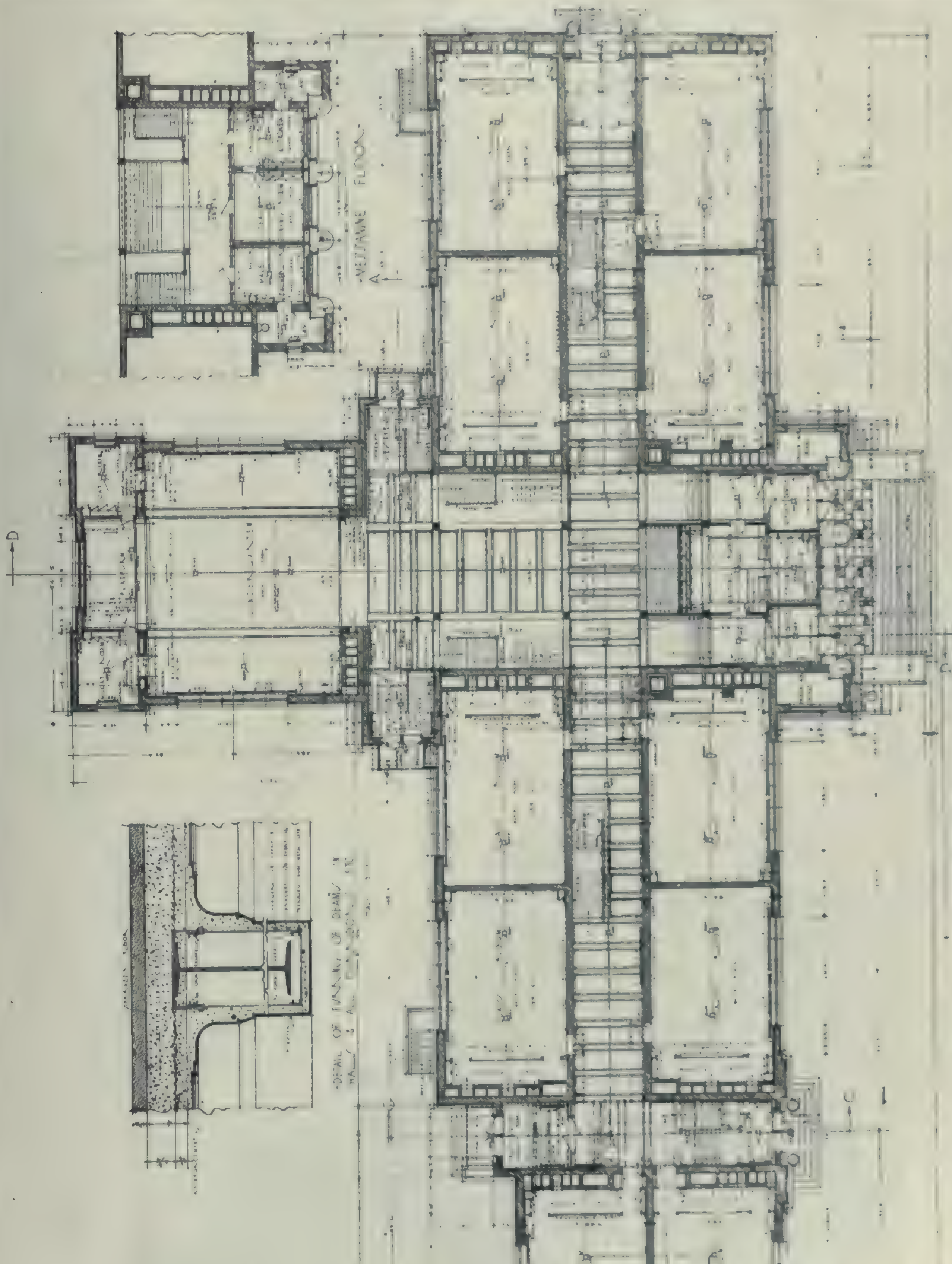


Fig. 2.—Ground Floor plan of Park School, Toronto.—Showing general layout of Principal's Office, Halls and Corridors, Class Rooms, Kindergarten, and Entrances.—Also plan of Mezzanine Floor.

ing surface of pavements are neither new nor novel. Their use by past generations was not handed down to us in sufficient detail to pass judgment upon them. Our experience is therefore very limited. In recent years but few mortar beds have been tried under brick and stone pavements.

The most interesting example with which the writer is acquainted is a small alley leading to a freight yard and warehouse in the rear of a wholesale establishment. The brick were laid upon the green mortar bed of concrete made with seven parts of coarse aggregate and one part of cement. The brick surface was made smooth by the use of a rammer upon a board placed upon the pavement. The joints were then filled with 1:1 cement-grout filler, as provided in our present specifications. This pavement has been subject to frequent as well as heavy traffic for more than ten years. It is in almost perfect condition and shows no impairment whatever either from thermal, traffic, humidity or frost effect.

It has been found that the resiliency of well-grouted brick pavements on a sand cushion ranges between 0.0003 and 0.0100. Considering it to be a fact that no brick in such pavements have ever suffered serious injury from shock, the question naturally arises, will injury result from shock in case the pavement slab is doubled in depth? We have in mind a monolithis structure which includes 4 inches of foundation; which structure, of course, will have less resiliency than the thinner slab.—Engineering News.

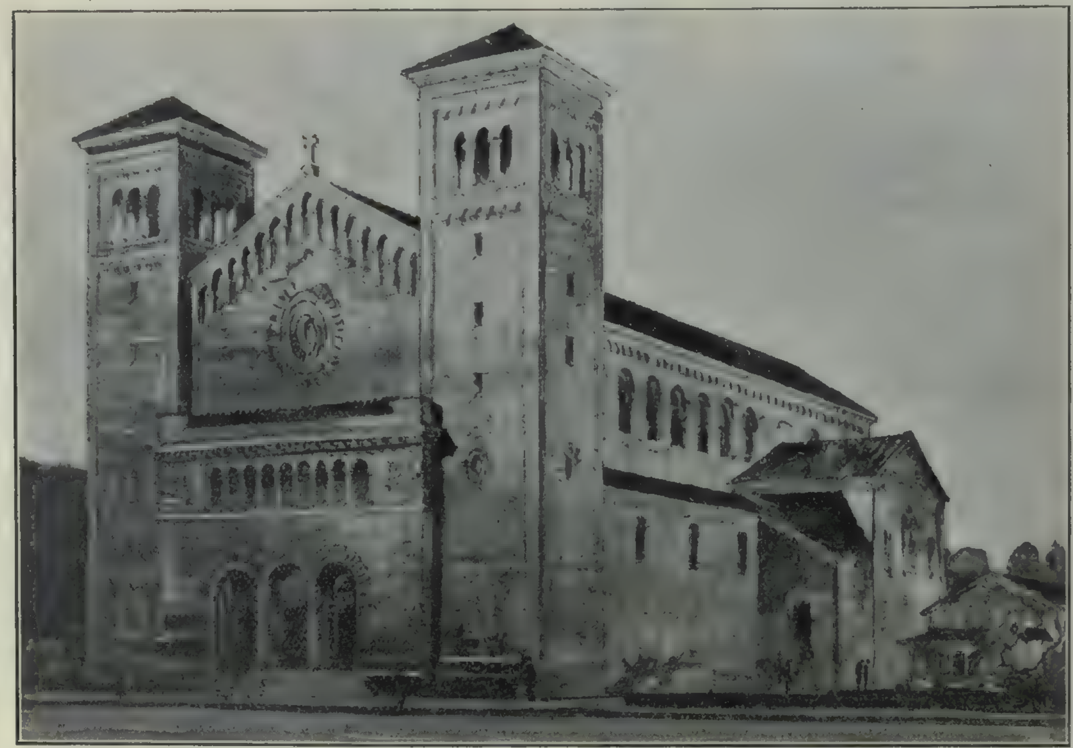
St. Pierre Claver Church, Montreal

THE contract for the Church of St. Pierre Claver with the presbytery, on Boulevard St. Joseph and Delorimier Avenue, Montreal, was recently let to Mr. A. Pion, Montreal. The Church, designed by Mr. J. O. Marchand and Messrs. Venne and Labelle, architects, Montreal, is in the early Italian style and will be erected on a site with a frontage of 171 feet on Boulevard St. Joseph and a depth of 218 feet on Delorimier Avenue.

The plans show a highly decorative structure, particularly in the interior. The foundations will be of concrete; the exterior of the superstructure of Montreal limestone, backed with terra-cotta and with reinforced concrete for pillars and beams to carry certain parts of the walls. A steel frame will be used to carry the structure. The floors will be of fireproof material and the roof of tile.

A feature of the church will be two towers, one on each side of the main entrances on St. Joseph Boulevard. Above these entrances will be windows giving light to the choir gallery and organ loft erected over the end of the church. A belfry will be placed in each of the towers. The basement will be used for devotional purposes; it will contain altars, vestries, etc., and will be reached through six entrances from the side streets and the towers. The main entrances to the church proper are by a flight of stone steps. There are to be a central nave and two aisles separated by columns in Scagliola on either side; the nave will have a caisson ceiling. The seating capacity is 1,100 in the basement and 1,200 in the auditorium, with 390 in the two transept galleries.

The adjoining presbytery will communicate with the church. The presbytery is also of Montreal limestone and contains administrative offices, baptistry and household accommodation.



St. Pierre Claver Church, Montreal

Street Cleaning Refuse Disposal

Mr. G. H. Hanna, before the recent International Road Congress, Worcester, Mass., outlines conditions in Cleveland—Cost of cleaning an important item

I have been requested to come here and talk to you in detail and explain the object of the Association of Street Cleaning and Refuse Disposal Officials of the United States and Canada. This organization has been in contemplation for some time. Thanks to the efforts of Commissioner Fetherston and Secretary Buchanan of the New York City Street Cleaning Department for their unceasing work and patience, it has now attained a growth which assures that branch of civic government an exchange of knowledge unsurpassed by any theoretical students of municipal problems. This is our main object; we hold that an interchange of ideas from practical men that have made our particular branch a study not from theory and unfathomable figures, but from actual experience work, thus giving cities or hamlets the benefit of a vast field of knowledge that could not otherwise be obtained.

Street Cleaning "Never Done"

Street cleaning is not a romantic subject. It does not arouse the enthusiasm of citizens like a new public building or similar work of construction. It is not so exciting as putting out a fire or suppressing a riot. It is less of a kid glove job than caring for parks and playgrounds. Like woman's work, it is "never done," but has to be repeated day after day and week after week.

The best street cleaning superintendent is the man you never hear about, because, if his work is done well, nobody ever thinks of him. If his work is neglected or badly done, he gets his name in letters an inch high on the front page of every paper. Yet, the street cleaning department is often the first agency of the city to feel the pruning knife, when it is necessary to cut down expenditures. That is how much glory there is in the street cleaning business. A street cleaner may save lives, by combating unsanitary conditions, but he gets no hero medals and no monuments.

I am not complaining of my job. I am simply explaining in advance why certain facts of which I will treat have escaped general attention. For example, it is common to divide paving costs under two heads, the cost of construction and the cost of repair. I maintain that the cost of cleaning is fully as significant a factor as the cost of repairs and is entitled to equal consideration in deciding any question of paving policy.

The street cleaner's task is more directly reducible to a question of dollars and cents than is the paving engineer's. When a street is clean it is clean, and there are no degrees of super excellence to aim for. It must be the superintendent's continual study to effect this cleaning as cheaply as possible, both because the public grudges money for street cleaning and because, if there is sufficient money, what is saved in economical cleaning can be applied to more frequent cleaning. Therefore, economy must be the theme of any practical discussion of street cleaning. I will try briefly to tell you the result of my experience in three elements of economy;

First, the cheapest method of cleaning pavements.
Second, methods of reducing litter.
Third, paving policy with a view to saving the cost of cleaning.

Flushers Very Satisfactory

The use of flushers has proven not only the cheapest but the most satisfactory method of street cleaning that our experience in Cleveland has been able to develop. We still make a considerable use of hand sweeping, but to make my point clear I need only refer to the statistics of our department, which show an average cost of 15.3 cents per square of 10,000 square feet for flushing, to which must be added practically nine cents for pick up work, a total of some 24 cents per square as against 42 cents for the work of the white wings.

The white wing is too convenient and necessary an adjunct to be wholly displaced under any conditions. Down-town streets must be swept continuously during the day, and the hand sweeper, with his small cart, can also work to advantage in the gutters of residence streets, collecting dirt that has either been flushed or blown to the curbs. But so far as our experience goes, the lessening of cleaning cost by cheaper methods means simply the extension of the use of flushers at every practicable point.

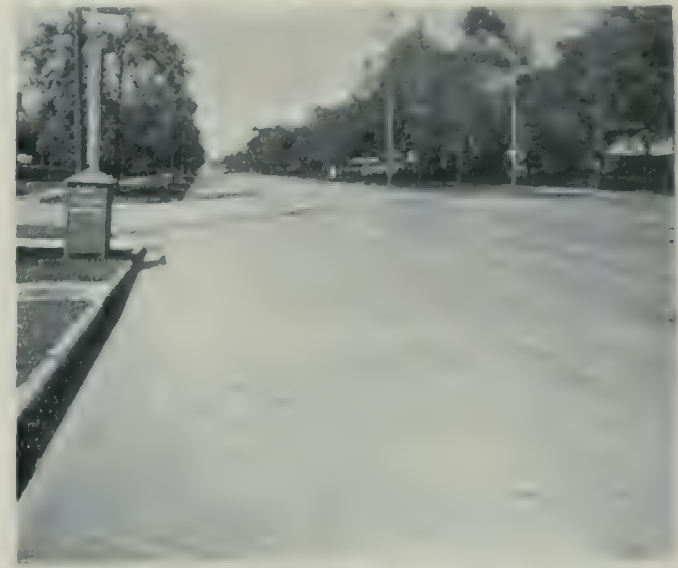


Fig. 1.—West 14th Street, Cleveland, Ohio.

There is an argument of sanitation in favor of the flushing method of cleaning. Dust breeds infection and is extremely unpleasant where it is not dangerous. Hand sweeping causes a certain amount of dust and mechanical sweeping usually causes still more. However, with all that can be said on this score, I am opposed to simple sprinkling as a means of laying dust. Ammonia and other products leach out of damp manure and form a scum on the surface of the street that is nearly impossible to remove and makes the pavement slippery and foul smelling. Water should always be applied with force enough to carry the refuse to the gutter, where it should be promptly collected with brooms and shovels and removed.

The prevention of litter in streets has been carried farther, perhaps, in more congested cities than has yet been necessary in Cleveland. Even in our most crowded quarters, the streets and sidewalks are rarely used as locations for garbage and ash cans, so one fruitful source of trouble in certain eastern cities is minimized in our case. We are reasonably successful in teaching the public to use waste paper boxes, but there is always room for improvement in such works of public education. We have tried during the past year to organize volunteer corps among school boys and girls who will use their influence against the useless littering of streets. The success of the venture is still at issue.

Cleanliness Encourages Cleanliness

On the long run, nothing encourages carefulness on the part of the public so much as efficient and careful cleaning. A man does not hesitate to throw paper or rubbish into a street that is already foul. He thinks twice, if the street is neat and clean. If there is a waste box at hand with a printed word of suggestion on the outside, he is apt to use the box.

The greatest source of expense in Cleveland has come not from those who use the street for traffic, but those who use it as a place of business. A few hundred square feet near a certain street corner cost our department $10,000 to keep clean during the year last past. It is the location of a curb market, supposedly a farmers' market, but really the resort of professional hucksters who dispose of provisions that have often become shop-worn in adjacent market houses before finding their way to the curb. It would be a small return for the privilege of doing business in the street to require these hucksters to keep their surroundings clean at their own expense, on pain of arrest or forfeiture of their privileges. My annual report recommends that some method be found of ridding the city of this form of imposition, and I think that if the principle is applied in most cities to their market districts it will result in a considerable saving of cost.

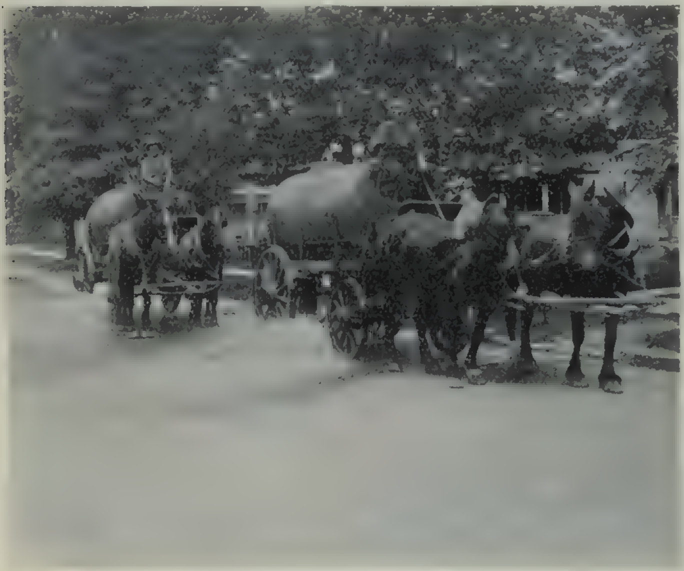


Fig. 2.—Automatic Flushers at work in Cleveland, Ohio.

In certain localities the mud that is tracked upon pavements is the greatest source of cleaning cost. Paving policies should be carried out with a view to having a minimum number of unpaved approaches to existing pavements. I want also to point out the need of protecting narrow rural pavements from the overflow or tracking of mud that originates on adjacent portions of the same highway. Where half of a road is paved, care should be exercised to prevent the unpaved portion from draining across the paved portion. If the pavement is so narrow that teams must turn partly off from it at meeting points, the berms should be covered with broken stones or cinders to prevent tracking mud on the pavement. Few streets are so dangerous to auto traffic as a narrow suburban pavement with a film of fluid mud over it. The pitch frequently encountered on such pavements is enough when covered with slime to keep an auto continually skidding toward the curb. The cost of cleaning, under these circumstances, is higher than on other streets with ten times the traffic. With proper drainage, a shower ought to be a means of cleansing, not a means of contamination for an outlying pavement, even though it covers only a portion of the roadway.

But the foregoing measures are not so important or effectual in saving the cost of street administration as is the construction and maintenance of pavements that are easy to clean. It is a continual wonder to me that so little weight is given to cleaning cost when paving questions are settled. An annual expense of $500 a mile in repairing residence streets would be considered an appreciable item of maintenance, yet that figure for cleaning a mile of residence street through a season is extremely low. A cost of $500 for maintaining a mile of one kind of pavement for a year as against a cost of $1,500 for maintaining another kind would be sufficient grounds, in most cases, to decide in favor of the former material. Yet greater differences than this in cleaning cost as between competing types are blandly overlooked.

Cleaning Costs

A street cleaner looks for two qualities in a pavement. It must be smooth and particles of litter must not stick to the surface. The question of smoothness opens up the whole matter of durability. Any material that deteriorates and roughens becomes more difficult each year to clean. Any neglect of needed repairs means a larger cleaning bill until the repairs have been completed. I do not think it is necessary for me to discuss the durability of materials. Many of you are authorities on that subject. I merely wish to emphasize one thought that should enter into all your calculations of expense, and that is, the two-fold expense resulting from wear, the cost of repairs plus the increased cost of cleaning.

Additional calculation of cleaning expense must be made for all bituminous pavements on account of the sticking of particles of litter to the surface. These surfaces are never quite so clean as non-adhesive materials, and it costs from 25 per cent. upward in additional cost to put them in a reasonably presentable condition, on account of this quality.

This difficulty is seen at its worst in a new creosoted wood block pavement, when the oil is gradually working out between the pores of the wood. The use of steel scrapers must often be employed, as the flushing by water is not effective at all in removing the dirt from such a surface.

The substances most easily cleaned, that enter into pavements, are brick and stone. Neither of them originates any form of dirt and both wash off readily. The only ground for discrimination between them is on the question of smoothness, where brick has a slight advantage, as a rule. But in the use of these materials, the choice of a filler is all important. A bituminous filler has all the disadvantages of a bituminous surface, from a cleaner's standpoint, and some others besides. Being softer than the brick or block, it recedes, leaving a crevice that invites the lodgment of dirt. With the edges of the brick or block unprotected, it is sure to roughen, thus adding to the difficulties of cleaning. In fact, such a street, after a few years, presents an array of cobble stones, with the filler invisible, or else melted and run to the gutter, where it impedes the work of the follow-up gang.

So what I say in praise of brick and block pavements is meant to apply only to those built with a cement grout filler. I regret that I must rely upon general observation rather than exact data in supporting some of my statements, but it happens that we have in our office the result of observations made upon West Fourteenth Street, Cleveland, with a view to determining the cost of cleaning. This is a grouted brick thoroughfare that has been paved some ten years, and yet is in good enough condition to serve as a model of minimum cleaning cost. This street has a traffic of about two vehicles a minute. It has been cleaned, on an average, five times a week, being flushed by night and hand swept in the day time. The sweeper worked almost exclusively in the gutters, as most of the dust on such a pavement will be blown to the curbing in dry weather. The cost, per cleaning, amounts almost exactly to 15 cents per 10,000 square feet, which we call a "square" and use as our unit of calculation.

15 cents per 10,000 ft.

This is the lowest figure that we have been able to achieve on any type of pavement. The cost on the best asphalt pavement would be not less than twenty cents, and would raise to thirty as the surface became wavy or rough. A wood block pavement costs practically a dollar a square to clean in its initial condition and it will be at least two years before the oil will have dried out sufficiently to admit of its being cleaned for thirty cents a square. A tar-filled block pavement will cost not less than thirty cents per square, and, as the filler disappears and the blocks roughen, this cost will amount to sixty cents or more.

So you can see how much weight I would put upon the question of cleaning cost in the selection of a material as well as its construction. In the case of a pavement forty feet wide, there are about twenty-one squares to the mile. As between a material that can be cleaned for 15 cents and one that can be cleaned for thirty cents, there is a difference of $3.15 per mile per cleaning, a difference of $15.75 per week, of $630 per season of forty weeks, and $6,300 in ten years. And, if, instead of thirty the cost of cleaning the latter pavement amounts to 60 cents per square, as is not uncommon under conditions of wear, the excess of cleaning cost will be $1,800 for a year or $18,000 for a decade above the figures that we have shown to be attainable on West Fourteenth Street. The successes of our department and the good sanitary record of our city are attributable in no small measure to the fact that we have miles of this type of brick pavement.

Cleaning costs can be greatly reduced by policy of prompt repairs. I believe in the continual patrol of all city streets by men whose duty it is to discover defects in pavements and prescribe repairs. Even from the standpoint of repair cost, such a system saves money. When cleaning is considered, as well as repairs, the saving of a patrol system is so great as to make any other system a luxury.

A bad pavement is the despair of the street cleaner. Every town has streets that ought to be called graveyards. There lie the remains of past paving failures, rutted, rough and unsightly, to reproach the men who laid them. As a street cleaning superintendent my last word of advice to you is to tear such pavements up and build pavements in which you can take pride. Build for ease of traction, build for durability, but also build for sanitation. Build a pavement that can be washed and swept clean. Such a policy is not expensive. The real extravagance is to keep pavements on your streets that are a barrier to traffic, a breeding place for germs and a burden upon the street cleaning department to keep in a condition of halfway presentability.

In view of our experience and the economy of cleaning streets of one kind compared with that of another, as well as the difference in economy that is apparent to the man on the job, of a street out of repair and one in a maximum state for use, I wish to seriously submit for your consideration as to whether or not those who design, construct and select pavements, have not lamentably failed in measuring the economy of a pavement by excluding every consideration that is involved in keeping them in clean sanitary condition—confining their consideration simply to cost of construction, maintenance and repair.

Reinforced Concrete T Beam Theory

By E. G. W. Montgomery[*]

THE determination of a reinforced concrete T section is at present effected in three ways, viz.: (1) an approximate mathematical method which neglects the compression in the stem when this is held to be inconsiderable; (2) a mathematical method which takes the compression in the stem into account when it is held to be considerable, but which depends for its application upon formulae so cumbrous as to be of little practical value; (3) tables and diagrams prepared by various writers which yield good results, but which necessitate several time-consuming operations.

All these methods seem intended to convey—and do convey to many users—the impression that the analysis of a T section is attended by peculiar difficulties, needing more than ordinary care and attention to surmount them; while the attempt made to distinguish between beams by the first two methods is mistaken, resting as it does upon the common, but erroneous belief that the compression in the stem, if considered, complicates the analysis. On the contrary, the inclusion of this factor within the analysis affords a simple and accurate means of establishing the ratio of width of flange to width of stem, which is important and leads directly to the determination of the required section.

T beams enter so largely into everyday structural design that it seems worth while to bring to the attention of interested readers two methods by which any T section can be determined as readily and accurately as a rectangular section, without resort to any new principle. That neither of these methods has been propounded by any other writer seems to be due to the presupposed intricacy of the subject diverting attention from its real simplicity.

In these methods the straight-line, no-tension (in concrete) theory is adopted, as being the one generally used;

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[*] Bridge Engineer, Highways Department, Province of Saskatchewan.

but it will be seen that the second method might be applied just as readily to the assumption of parabolic variation in compressive stress.

The following notation will apply:—

t = thickness of flange.
b = width of flange.
b' = width of stem.
d = effective depth.
kd = depth from extreme compressive fibre to neutral axis.
jd = length of couple arm.
q = distance of centre of compression above neutral axis.
E_s = modulus of elasticity of steel.
E_c = modulus of elasticity of concrete.

$$n = \frac{E_s}{E_c}$$

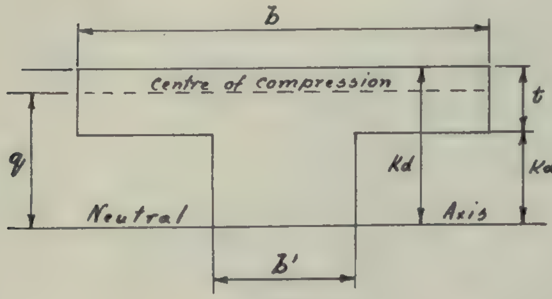

Fig. 1

f_s = unit working stress in steel.
f_c = extreme unit working stress in concrete.
A_s = area of steel in tension.
A_c = equivalent area of concrete in compression.
B.M. = bending moment.
R.M. = moment of resistance.
V = maximum shear.
v = permissible unit shear.

First Method

In a T beam, as in a rectangular beam, the position of the neutral axis is determined by the equation,

$$kd = \frac{nf_c d}{nf_c + f_s} \quad \dots \dots \dots \dots \dots \dots \dots \dots \quad (1)$$

The height of the centre of compression above the neutral

$$\text{axis} = \frac{\text{second moment area above the N.A., about the N.A.}}{\text{first moment area above the N.A., about the N.A.}}$$

Therefore, referring to Fig. 1, the position of the centre of compression is determined by the equation,

$$q = \frac{\dfrac{bkd^3}{3} - \dfrac{(b - b')\ (kd - t)^3}{3}}{\dfrac{bkd^2}{2} - \dfrac{(b - b')\ (kd - t)^2}{2}}$$

Now, to turn this equation to account, it becomes necessary to determine the position of the centre of compression in advance. Thus, if it is desired to have the centre of compression at 2t/5 below the upper surface of the flange, substitute kd — 2t/5 for q in the equation, and solve. By this means the five equations following are established. When the centre of compression is at 2t/5

$$\frac{b}{b'} = 1 + \frac{kd^2\ (5kd - 6t)}{t^2\ (4t - 3kd)}$$

and, to obtain a rational result, t must lie between 3kd/4 and 5kd/6 ... ... (2)

When the centre of compression is at 9t/20

$$\frac{b}{b'} = 1 + \frac{kd^2\ (20kd - 27t)}{t^2\ (13t - 6kd)}$$

and t must lie between 6kd/13 and 20kd/27 ... ..: ... (3)

When the centre of compression is at t/2

$$\frac{b}{b'} = 1 + \frac{kd^2\ (2kd - 3t)}{t^3}$$

and t must be less than 2kd/3 ... ... (4)

When the centre of compression is at 3t/5

$$\frac{b}{b'} = 1 + \frac{kd^2\ (5kd - 9t)}{t^2\ (t + 3kd)}$$

and t must be less than 5kd/9 ... ... (5)

When the centre of compression is at 4t/5

$$\frac{b}{b'} = 1 + \frac{kd^2\ (5kd - 12t)}{t^2\ (9kd - 2t)}$$

and t must be less than 5kd/12 ... ... (6)

It will be observed that these five equations apply to the case in which the neutral axis falls below the flange. When the centre of compression is at t/3, kd = t, and the ratio b/b' is unity. When kd is less than t, that is when the neutral axis falls within the flange, the ratio b/b' is again unity. In both these cases the treatment for a rectangular section applies; but it is to be noted that b' will not represent the width of the stem, but will represent that width of flange which is assumed to act in compression.

Since the extreme fibre stress in the concrete is equal to f_c, the stress in the fibres at the bottom of the flange will be equal to $f_c \dfrac{kd - t}{kd}$ for the assumption of linear variation in stress. Hence, taking the compression in the stem into account, the total compression in the concrete is equal to

$$\frac{f_c}{2} \times b'kd + [f_c + f_c \frac{kd - t}{kd})]\ (b - b') \times \frac{t}{2} \quad \text{(see Fig. 2)}$$

Simplifying and excluding the term denoting average unit stress, viz., $\dfrac{f_c}{2}$; we obtain the equation

$$A_c = b'kd + [t(b - b')\ (2 - \frac{t}{kd})] \quad \dots \dots \dots \dots \quad (7)$$

$$\text{B.M.} = \text{M.R.} = \frac{A_c \times f_c}{2} \times jd \quad \dots \dots \dots \dots \dots \quad (8)$$

$$A_s = \frac{A_c \times f_c}{2f_s} = \frac{\text{B.M.}}{f_s jd} \quad \dots \dots \dots \dots \dots \dots \dots \quad (9)$$

$$b' \times d \text{ is equal to, or greater than, } \frac{V}{v} \quad \dots \dots \dots \dots \quad (10)$$

To illustrate the application of the analysis consider an independent girder, of T section, to sustain a bending moment of 9,600,000 in.-lbs., and a maximum shear of 80,000 lbs. Given a span = 40 ft.; thickness of flange = 12 ins.; v = 100 lbs. per sq. in.; f_c = 600 lbs./in²; f_s = 15,000 lbs./in²; n = 15 (see 2nd edition, Turneaure & Maurer, "Principles of Reinforced Concrete Construction," pp. 238-240).

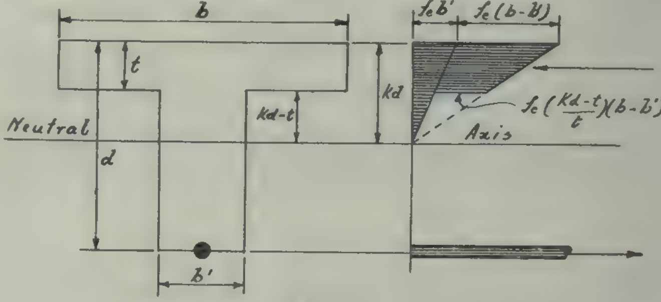

Fig. 2

It is customary to commence the design by satisfying eq. (10), but it will be found that this equation will almost invariably be satisfied at the first trial by proceeding as follows:—

Let centre of compression be at 9t/20. Then from eq. (3), kd must lie between 16.2 in. and 26 in. Assume kd = 18 in. Then from eq. (1)

$$d = \frac{18(15 \times 600 + 15000)}{15 \times 600}$$
$$= 48 \text{ in.}$$

$$\text{therefore } jd = 48 \text{ in.} - (\frac{9}{20} \times 12 \text{ in.})$$
$$= 42.6 \text{ in.}$$

from eq. (3)

$$\frac{b}{b'} = 1 + \frac{18^2\ (20 \times 18 - 27 \times 12)}{12^2\ (13 \times 12 - 6 \times 18)}$$

$$= 2\frac{11}{16}$$

Substituting values in eq. (7)

$$A_c = 18b' + [12\ (2\frac{11}{16}b' - b')]\ (2 - \frac{12}{18})$$

$$= 45b'$$

Substituting values in eq. (8)

$$9{,}600{,}000 = 45b' \times 600 \times 42.6 \times \frac{1}{2}$$

whence $b' = 16.693$ in.
therefore $b = 44.862$ in.

Now if this value for (b) does not exceed the width of flange permissible for the given case, and if the value for (b′) provides a stem that satisfies eq. (10), then the section is acceptable and may be completed by solving for (A_s). If both these conditions are not satisfied trial must be remade with a new value for (kd).

In this case both conditions are satisfied, and from eq. (9)
$A_s = 15.023$ sq. ins.

The section can therefore be completed as shown in Fig. 3, and it might be compared with the section presented in the work from which the example has been taken.

Second Method

This method exhibits a principle of the T section that appears to have escaped notice hitherto, and as the treatment is that for a rectangular section, the need for aids to memory is eliminated.

Referring to Fig. 4 it will be found that the resisting moment of the T section is equal to the resisting moment of the rectangular section A, B, C, D diminished by the resisting moments of the rectangular sections D, E, J, H and C, F, K, G when each of these is regarded as an independent section with its centre of compression at two-thirds the height of its extreme compressive fibre above the common neutral axis, N.A. The extreme compressive fibres for the last two sections lie along the plane E, F and the intensity of stress along this plane will, of course, be that due to its distance from the common neutral axis.

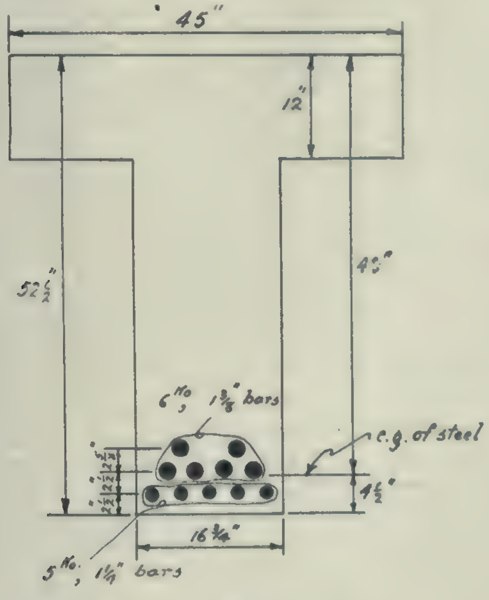

Fig. 3

For the purpose of this discussion it will be sufficient to demonstrate this truth by testing it upon the example worked out by the first method.

Referring to Fig. 5, for the overall stem

$$\text{R.M.} = 16.693 \times 18 \times \frac{600}{2} \times (48 - \frac{18}{3})$$

$$= 3{,}785{,}915 \text{ in. lbs.}$$

$$\text{Therefore R.M. per inch width of stem} = \frac{3{,}785{,}915}{16.693} \text{ in. lbs.}$$

$$= 226{,}800 \text{ in. lbs.}$$

$$\left.\begin{array}{l}\text{Also R.M. required}\\ \text{in flange projections}\end{array}\right\} = (9{,}600{,}000 - 3{,}785{,}915) \text{ in. lbs}$$

$$= 5{,}814{,}085 \text{ in. lbs.}$$

$$\left.\begin{array}{l}\text{Now R.M. per inch}\\ \text{width of voids under flange}\end{array}\right\} = 1 \times 6 \times \frac{6}{18} \times \frac{600}{2} \times (36 - \frac{6}{3}) \text{ in. lbs}$$

$$= 20{,}400 \text{ in. lbs}$$

$$\left.\begin{array}{l}\text{Therefore R.M. per}\\ \text{inch width of}\\ \text{flange projections}\end{array}\right\} = (226{,}800 - 20{,}400) \text{ in. lbs}$$

$$= 206{,}400 \text{ in. lbs.}$$

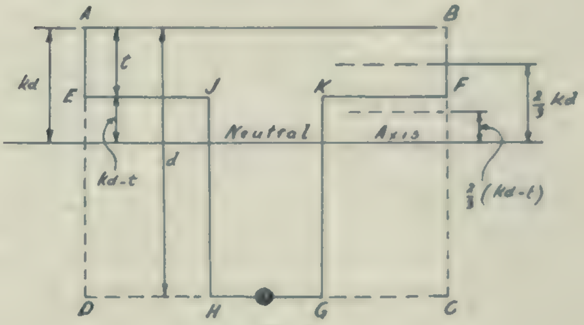

Fig. 4

$$\left.\begin{array}{l}\text{Therefore required}\\ \text{length of flange}\\ \text{projections}\end{array}\right\} = \frac{5{,}814{,}085}{206{,}400}$$

$$= 28.169 \text{ in.}$$

$$\left.\begin{array}{l}\text{Therefore total width}\\ \text{of flange}\end{array}\right\} = (16.693 + 28.169) \text{ ins.}$$

$$= 44.862 \text{ ins.}$$

which is the exact result obtained by the first method.

The application of the method can now be explained briefly. When a T section to sustain a given bending moment and shear is sought—the other necessary data being also given—first find the dimensions that will satisfy eq. (10), and then obtain the width of flange by the process traced above. If the width so obtained is permissible for the given case, there only remains to find the area of tensile reinforcement by eq. (9), using the form

$$A_s = \frac{A_c \times f_c}{2f_s}$$

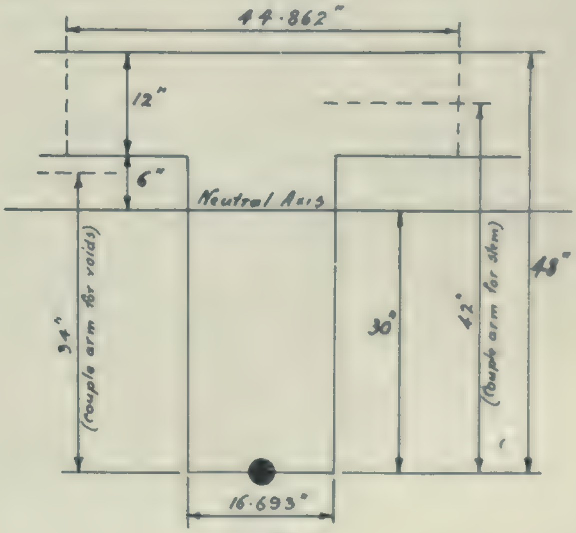

Fig. 5

The value of A_c will be that given by eq. (7).

It will be observed that for this method it is not necessary to know the length of the couple arm, but the curious might find the position of the centre of compression by the equation referring to Fig. 1, and having obtained the length of couple arm therefrom, satisfy themselves that the resisting moments in concrete and steel are as required.

In the Public Eye

A budget of comment presented in the interest of public welfare, independent of party politics and with malice toward no one.

General Bertram has paused to dig a few trenches around the grave of the late lamented Shell Committee and train the heavy guns of his typewriter on the critics of the dear departed. But, sad as it may seem, General Bertram's defence, which appears in an open letter to Sir Sam Hughes, is at points strongly at variance with some statements made by D. A. Thomas, who, at the instance of Lloyd George, came, saw and spoke ere he departed. And what he said misled even the Government organs into thinking that certain contractors had "striven to get large profits out of their contracts." But hear what General Bertram says:

"For various reasons while chairman I have refrained from giving out a statement of prices as compared with prices in England and the United States. But I can assure the public that in nearly every case our prices are lower in this country. I have before me now a comparison of prices which will prove my statement."

* * *

But hold a minute! Perhaps we can reconcile the above with Mr. Thomas' remark that certain manufacturers were getting larger profits than they were entitled to. Perhaps General Bertram is speaking of the prices of to-day. And Mr. Thomas may have been thinking of the prices before those famous interviews in which Mr. F. P. Jones denies taking so important a part. This really looks like a reasonable conclusion, for further on in his letter General Bertram goes on to say:

"As the business developed in Canada, as experience was gained, we were enabled greatly to reduce the cost of production, so much so that on our present contracts we expect to save the Imperial Government probably $30,000,000 as between the price of the original orders and the prices now being paid to the manufacturers."

* * *

You'll remember it was reported that the aforementioned interviews, the cancellation of approved tenders that followed, and the subsequent letting of contracts on new tenders, saved the British Government $21,000,000. The denial subsequently issued declared these figures to be incorrect. Has General Bertram at last given us the true figures? Or must Mr. Jones get credit for only part of the saving and part of the credit be given to the demand for contracts caused by the new policy of letting them by open tenders?

* * *

General Bertram appears to take credit for the Shell Committee from strange sources. For instance, he proudly asserts that Canadian manufacturers undertook contracts without any financial advance, whereas in England the Munitions Department advances the money for the complete equipment of their factories. In other words, he pats himself on the back because Canadian manufacturers were possessed of enterprise of which his committee and the Government behind it were utterly lacking. It is no fault of the Shell Committee that the shell making industry has made some progress in Canada. It is the fault of both the Shell Committee and the Government that the industry is not double its present volume.

By the way, we are still waiting to hear what Premier Hearst has to say to his wayward follower J. R. Follis, M.P.P. for Peel. Will he read him a little lecture on the evils of horse trading and tell him to sit low in the back benches till the trouble blows over? Or will he come out cold and hard and tell the errant James that he who would profit by Government horse deals has no place in the ranks of the grand old party of Sir James Whitney? By the way, what would Sir James have done? The Government is being weakened by this silence on the part of Mr. Hearst.

* * *

If shells are being made in Canada cheaper and more quickly than they are in the United States and England, why is it that hundreds of millions in contracts are being spent in the United States, where only tens of millions are placed here? Perhaps General Bertram, who is responsible for the statement, will write another letter and answer this question. In the same letter he might mention why, when a Hamilton manufacturer offered to make shells at cost, his offer was not accepted.

* * *

"We were asked to bid on 5 in. shells," says a manufacturer, " and bid a price the same as other firms. A few days ago we received an answer that our tender could not be accepted, no reason being given." Perhaps when General Bertram writes his next letter he will give the reason.

* * *

The Liberal press is inclined to the belief that the Government's life should be extended. Making all due allowance for patriotism, desire that nothing should interfere with the successful carrying on of the war, etc., this being interpreted means that the Liberals do not want an election at present. They naturally feel that there are few, if any, reasons why the people should return them to power. They know that when they do get back to the seats of the mighty it will be because of the other party's sins, rather than their own virtues. Consequently they would tarry yet a little longer in the shades of Opposition. With the Shell Committee refusing to stay buried, Sir Sam Hughes still talking, the Ross rifle being daily condemned by soldiers returning from the front, and the Government taking no steps to clear up the growing mass of rumors, they feel that a little patience is not only a virtue but likely to prove a paying proposition. It is not ours to advise great men. But from here it looks as if sharp action by the Government, both as to the source of the rumors and the date of the election, would produce great results. It is a wise party that does what its opponents don't want it to do.

* * *

What has become of the proposition to tax war contract profits? In these days when there is a subscription list on every corner and a begging letter in every mail it would be a mighty popular Government that would make the profiteers disgorge and apply the proceeds to the various patriotic funds. It is all right to "give, give, give," but the day is approaching when the liberal must quit because of empty pockets. Soldiers' families must not starve; returned soldiers must be cared for. The Government is after all the responsible party. It must look for money where the money is. The "profiteers" have some of it.

* * *

That the critical stage in recruiting has been reached is admitted. That old methods of securing recruits are worn out—acknowledged. Handing dodgers to men on street corners has lost its charm. It remains for those in charge to go about their work scientifically. Some time ago it was suggested to Sir Sam Hughes that if certain classes were organized into battalions results might be obtained. As the suggestion was not accompanied by a verbal boquet it received scant attention. But if an "accountants' battalion," a "merchants' battalion" or a "bookkeepers' battalion" was formed might it not have the effect of drawing men who rather shrink from the possibility of being compelled to bunk with some man a police magistrate has given the choice of enlisting or going to jail? It might be tried.

* * *

Mr. McAvity, manager of the Buffalo Forge Company of Berlin, who has been engaged by the Imperial Munitions Board to act in an advisory capacity looks to me like the right man in the right place. He not only has expert knowledge of the manufacture of shells, but is a man of good judgment and wide business experience. He should give valuable assistance to the Committee. The latter evidently means well and if it were built on a somewhat broader gauge could do much to repair the damage done by the Shell Committee. Anyway it is deserving of a chance to show what it can do.

* * *

And now the good old Tory Ottawa Journal has crawled over the fence into the camp of those who are demanding an investigation of the Shell Committee. It may have decided to take the hurdle after being assured that Liberals as well as Conservatives have been taking a hand in the shell game, for, as partial justification for its course, it quotes the following from the Hamilton Herald:

"The Montreal Herald has been extremely vigorous in its denunciation of war profiteering and profiteers. But the Montreal Herald's esteemed local contemporary, the Mail, discloses the fact that the editor of the Herald, the Hon. George P. Graham, is a director of a company which has been clearing a profit of 100 per cent. out of the manufacture of war munitions. The joke seems to be on the Herald."

Anyway, while the Journal does not think that Brockville's favorite orator has very much interest in any company so occupied it gravely arrives at the conclusion that "the important thing is that there should be an enquiry into the question of shell profits," and it winds up with the following: "Explanations are needed—not on behalf of the Dominion Government, which had nothing to do with the matter, but on behalf of the former Shell Committee and the manufacturers."

* * *

And, while I heartily agree that explanations are in order, I cannot accept the statement that the Dominion Government had nothing to do with it. The Dominion Government gave birth to the Shell Committee. It may be its "war baby" and the Government may be heartily ashamed of it. It may have shifted its burial to the Imperial authorities, but it cannot escape responsibility for its birth. It may make some reparation if it bares its record to the public. Who knows but there may have been good as well as bad in that record? But when the Government organs start in to disown it, the public can be excused for having a few suspicions.

* * *

There is a large curiosity as to who the company are who took over that shell contract from the Grand Trunk Pacific and leased the Transcona shops from the Government to carry on the work. A mysterious group of capitalists visited the Transcona shops just prior to the transfer and they are supposed to have something to do with it.

* * *

Huron county struck a new note in the giving line when it refused to make a grant to the recruiting fund. Two reasons are given by the county council for its action. The first is that the Government should pay the cost of recruiting. The second is that there are hundreds of men in the towns and cities who can be much better spared than those who till the soil and raise the food for the men who fight. And both reasons have a certain amount of appeal. Recruiting is just as much government work as clothing and drilling the men who have been recruited. As for the hired man on the farm, he always has been and always will be a scarce commodity. His work is so incessant and such a deadly routine that even camp life is lively compared to it. It is a good guess that if the Canadian army lists were analyzed there would be found a greater proportion of "hired men" and bank clerks than any other calling. You can't blame the farmers of Huron for refusing to further a movement calculated to make them do the hired man's work and "the chores" as well. In all fairness to the Huron council it must be added that it was no spirit of parsimony that prompted their protest. They voted $6,000 a month to the Patriotic Fund—the largest amount voted by any Ontario county council.

* * *

Over on the battlefield the vultures fly; in each war worn country the army contractors gather. Even poor old France, whose heroism has awakened the admiration of the world is having trouble with them. The Chamber of Deputies has found it necessary to appoint a committee to enquire into contracts. One of the duties will be to investigate a "horse deal" which is said to have involved several million francs paid in commissions. And in this connection the Winnipeg Tribune recalls "a statement published a few weeks ago that a prominent politician resident at Ottawa had received a contract from the French government to supply remounts for the war. By buying horses in the northwestern states and delivering them in France he made a profit, according to his own alleged admission, of $100,000. It is asserted that his secretary said the profits were $300,000."

Is nothing held sacred by our Canadian financier? Surely poor old France had suffered enough at the hands of the Kaiser! That she should also have to pass through the hands of an Ottawa politician is piling agony on the suffering. Belgium next.

* * *

They had a little mix-up over the raising of a battalion up in Wellington county which gives rise to a suggestion that a little political pull is no detriment to a man who really wants a command. When it was first proposed to raise the Wellington battalion Lieut.-Col. Taylor was sent down from London to recruit and presumably lead it into the field. After he had got the county fairly well organized Lieut.-Col. Craig suddenly awoke to the fact that he was overlooking a bet. Col. Craig is a former M.P.P. and a firm friend of the member of the Dominion House who is also of the Conservative persuasion. A hurried trip to Ottawa was followed by the announcement that two battalions were to be raised in Wellington, one in the north and the other in the south, Col. Craig to have the north and Col. Taylor the south. Then it was discovered that two were one too many for the men available. So Col. Taylor was recalled to headquarters and Col. Craig took over the whole county. Neatly worked, wasn't it?

* * *

"Gott strafe England" is the cry of baffled rage that comes out of Germany. And well may the Huns ask God to punish Britain, for after more than a year of war it is more than ever evident that the Kaiser can't. Germany, by her "preparedness," has been able to brutalize Belgium, seize the richest part of France, put the steam roller over poor little Servia, and drive the Russians out of Warsaw. But to-day, with the possible exception of one or two small posts in East Africa, she does not hold one foot of British soil. The Empire on which the sun never sets is, by reason of its far-flung dominions, the most vulnerable to attack of any of the allies. But though Germany may sing her hymn of hate she cannot touch even one of Britain's scattered island possessions! On the other hand, the blundering Britisher has swept German commerce from the seas and seized her Pacific islands and most of her African colonies. And in the meantime Britain's "contemptible little army" has grown to a quite respectable gathering of gentlemen in Khaki numbering in the neighborhood of four millions. Even if our politicians and generals do make an occasional blunder it is good to be a Britisher.

* * *

It is good business for a political party to keep systematically in touch with its rank-and-file. The best men in Canada are not all in Parliament, and those green baize doors at Ottawa are wonderfully effective insulators against new ideas.—Montreal Star.

This from a strong Tory paper. The clouds of the coming storm continue to gather.

SEARCHLIGHT.

Personal

George Edward Bell, a McGill graduate, of the staff of the Dominion Bridge Company, and Robert George Kyd, Town Engineer of Dunnville, Ont., have been elected associate members of the Institution of Civil Engineers.

Captain A. Charlebois, who was wounded at Festubert, and was invalided home to Montreal, has been authorized by the Minister of Militia to raise a company of French-Canadian engineers, to consist of 246 men and six officers.

Sir William Price, President of the Quebec Harbor Commission, has notified the Hon. Sir Sam Hughes, Minister of Militia, that he is prepared to recruit a regiment in Quebec and district, the regiment to be composed of both French and English-speaking Canadians.

Lieut. Ralph Harris, formerly of the Toronto Roadways Department, has been wounded and is now in a Boulogne hospital. Lieut. Harris enlisted in the Corps of Guides, and after they were disbanded joined the Canadian Artillery. In England he was transferred to the Royal Engineers. He is a graduate of the School of Practical Science, Toronto.

Among the many in engineering circles who have sacrificed lucrative positions to fight for the Empire is Mr. Frederick Burchell, C.E., of Sydney, N. S., who is a bombardier in the 63rd Battery, now mobilized at Fredericton. Mr. Burchell received his degree of Civil Engineer at Queen's University, Kingston, Ont., and when the war broke out he was occupying an important position with the Nova Scotia Construction Company, at Halifax. He intended to qualify for a commission, but realizing how many applicants there were for officers' commissions, he enlisted as a gunner with the 63rd Battery, being afterwards promoted to his present rank.

According to the statement of Major R. W. Coulthard, commander of the No. 2 Tunnelling Company of Engineers at present being formed in Calgary, two companies composed of men fitted for mining operations are being formed in Canada. One is in Calgary, and will be composed of western miners, and the others, with headquarters at Pembroke, Ont., will be made up chiefly of men from the Cobalt mining region. Major Coulthard states that the men of his company, which is now recruited up to about half strength, are all miners used to soft ground work, as well as the handling of high explosives. Its officers will be qualified mining engineers. Major Coulthard has himself been a mining engineer for the last sixteen years, and has done a considerable amount of work in British Columbia. He has had military experience with militia regiments, having held commissions with the Kootenay Rifles of Fernie and the Fourth Field Troop of Canadian Engineers at Calgary. He states that he expects his company to be recruited up to strength within a few weeks, and that it will leave for overseas early in the spring.

Obituary

Hugh E. Gallagher, of the firm of J. Gallagher & Son, marble workers, Woodstock, N. B., is dead, at the age of sixty-two.

The death occurred recently of Mr. Edwin M. Smith, vice-president of the Western Dry Dock and Shipbuilding Company, Port Arthur, Ont.

David Arthur Low, superintendent of water-works at Prince Albert, Sask., died in Winnipeg on the 9th inst., at the age of 46. He leaves a wife, his mother, two brothers, and one sister.

Mr. John Hitch, Sr., a well-known resident of Ridgetown, Ont., died recently at the age of 75. The late Mr. Hitch went to Ridgetown twenty-seven years ago, and ran an up-to-date brick and tile yard there. He was born in Ely, Cambridgeshire, England.

After an illness lasting only a few days, the death took place, on the 20th inst., of Mr. William Day, one of the oldest residents of Guelph, Ont. Mr. Day had lived in Guelph all his life, and carried on business there as a builder and contractor for a number of years. He was considered one of the best plasterers in Canada at one time, and much of his work remains in many of the public buildings and homes of Guelph. He was in his seventy-eighth year. A son and daughter survive him.

The death of a recognized leader in scientific pursuits has taken place in the person of Mr. Thomas Leopold Willson, of Ottawa, who died in New York on the 20th inst. Mr. Willson was noted principally for his discovery of acetylene gas for commercial purposes, in 1892. He was also the inventor of the acetylene gas buoys and beacons which bear his name, and which are now used as an aid to navigation all over the world. His most recent discovery was that of a chemical fertilizer, for the production of which he received a large concession from the Newfoundland Government. Mr. Willson was born in Princeton, Ont., in 1860, and received his early education at the public school there and at the Hamilton Collegiate Institute. He commenced his scientific endeavors in 1880, and in the same year gave to the city of Hamilton its first arc lamps. In 1909 he was awarded the first McCharles prize by Toronto University.

Mainly Constructional

East and West—From Coast to Coast

Eighty-eight employees of the Roadways Department of the city of Toronto have enlisted for overseas service.

Part of the stock of the Montreal Wood Mosaic Flooring Company, Limited, Montreal, was damaged by fire recently. The loss is covered by insurance.

J. E. Shea, J. Martin, and N. Paquette have registered at Montreal, and will carry on business under the style of the Dominion Plaster Board Manufacturing Company.

The City Council of Brockville, Ont., have approved of the tender of the Roberts Filtration Company, Derby, Penn., for the erection of a filtration plant at a cost of $86,000.

Such rapid headway has been made on the superstructure of the new Quebec bridge that it may be completed about September of 1916. This would be a year ahead of the estimates made at the time the work was undertaken.

E. and G. Castonguay, general contractors, Longue Pointe, Montreal, have registered under the style of Castonguay & Frere.

The Automatic Faucet Company, Limited, has been incorporated with head office at Vancouver and a capital of one hundred thousand dollars.

The Three-O-System Company, Limited, of Toronto, have obtained a charter, and will manufacture furnaces, stoves, boilers, radiators, etc. Their capital stock is $250,000.

The City Council of Ottawa have carried a vote to begin work on the Rideau River intercepting sewer immediately, without submitting the matter to the vote of the property owners.

The official inspection of a new branch line of twenty-five miles along the Quebec Central Railway, running from St. Sabine, Bellechasse, to English Lake, in Montmagny County, took place on December 22.

The interim report of Works Commissioner Harris, Toronto, shows that during the eleven months of 1915 ending November 30th, 32,867 miles of new pavements and 58,567 miles of concrete sidewalks were laid within the city.

An application has been filed at Ottawa for the incorporation of the Ontario Niagara Connecting Bridge Company, of Niagara Falls, Ont. This company plan to construct a bridge and railway, with terminals, over the Niagara River.

The Board of Control of the city of Toronto have recommended to the City Council that a steel and concrete bridge combined be built through Mount Pleasant Cemetery instead of one entirely of concrete. A saving of $12,000 will thus be effected.

Representatives of a number of railway construction contracting firms have been in Fredericton, N. B., looking over the ground preparatory to submitting tenders for construction of an extension of the St. John Valley Railway north of Centreville and south of Gagetown. The work involves an expenditure of about two million dollars.

The Regina Branch of the Canadian Society of Civil Engineers held a monthly meeting on Thursday evening at the Assiniboia Club. The members partook of a supper in one of the club's dining rooms, after which a very interesting paper was read by the chairman, O. W. Smith, on the subject of "Specifications," dealing with it from a contractor's point of view. A general discussion of the paper read concluded the evening.

Whether lodges and other institutions in whose buildings dances and other social entertainments are held should be fitted up with all the fire protective appliances that are installed in buildings which come under the head of licensed premises was the subject of some discussion at a meeting of the Property Committee of Toronto. Mr. Pearse, the City Architect, recommended in the affirmative, and a motion was carried to that effect.

The third annual Canadian and International Good Roads Congress will be held at Sohmer Park, Montreal, from March 6 to 10. Over two thousand delegates from the various provinces of Canada, with representatives from the United States and Great Britain, will be in attendance. The congress is held under the auspices of the Dominion Good Roads Association, with the active support of the provincial associations and governments, and the various motor bodies of Canada.

The city of Montreal, on December 20, applied to the Dominion Railway Commission to compel the Grand Trunk Railway to raise its tracks, at a cost of about four million dollars. The company agreed that the work was necessary, but argued that it was impossible to secure the money at the present time on sufficiently low terms. The representative of the city replied that the money could be obtained in New York. The Commissioners decided to investigate further the question of financing the work.

On the afternoon of Saturday, December 18th, the new viaduct across the old Welland Canal, St. Catharines, Ont., was opened to traffic. This viaduct cost $155,000 to build, and a cost of right-of-way of $167,000 brought the total gross cost to $322,000. Of this amount the Grand Trunk Railway bears $20,000 and the Dominion Government $50,000. The bridge itself is 1,236 feet in length, and 89 feet above the channel of the old canal. It is expected that the formal opening of the bridge will take place next spring or summer.

At 11.30 on the morning of December 20th the east and west headings in the Canadian Pacific Railway tunnel which has been drilled through Mount Macdonald were joined. The ceremony of firing the connecting shot was performed in the presence of a number of prominent railway and business men, engineers, and four ladies, two and a half miles from either exit, six thousand feet below the surface. The work on this famous Rogers Pass Tunnel has been marked by speed and efficiency since the contract was let in July, 1913, for the east, and in May, 1914, for the west end. It is expected that it will be finished by the fall of 1916. When complete it will be 26,400 feet long. Its width is 29 feet, and its height 21 feet.

The first general meeting of the British Columbia Division of the Canadian Society of Civil Engineers was held in the Board of Trade rooms, Vancouver, on December 11th. Some fifty members from the cities of Victoria and Vancouver were present, and interesting discussions were indulged in on matters relating to organization and topics of particular interest to the engineering profession. A committee was appointed to report on proposed amendments to the constitution. The officers who were named at the preliminary organization of the society a few months ago were confirmed. Mr. T. H. White will be chairman of the British Columbia Division for the ensuing year, and Mr. E. A. Cleveland secretary.

As a result of the forcible arguments put forward by Mr. Thomas Adams, the town planning expert, of Ottawa, at a conference held at Galt, Ont., on the 16th inst., the delegates of the cities and towns of Galt, Preston, Berlin, Waterloo, and Paris passed a resolution desiring "that legislation should be passed in Ontario at the next session of Parliament to enable cities, towns, and other municipalities to prepare town planning schemes for the purpose of securing amenity, convenience, and proper sanitary conditions in their areas." Mr. Adams urged the necessity of establishing a Department of Municipal Affairs at Toronto as a means of building up a system of town planning and ensuring some uniformity of method in municipal administration.

After six years' work, Montreal's revised building code is complete. The code is divided into two parts. The main part is the general building by-law governing construction throughout the city, and the other is composed of over a hundred special by-laws relating to buildings on certain streets or street sections. It was the first part that took so long to revise. Every detail was brought up to date, ensuring that local construction will be of the most modern and approved type. The special by-laws originally numbered over two hundred. With the revision of the general by-law the special measures were reduced to one hundred, and now have been compiled in such a manner that the rules applying to construction on every street or street section may be readily known.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks Sewerage and Roadways

Bala, Ont.
A by-law to authorize the expenditure of $5,000 on road construction will be submitted to the ratepayers on January 3.

Carleton County, Ont.
The County Council will submit a bylaw to the ratepayers to provide for the expenditure of $40,000 on the construction of highways throughout the County. Clerk, Charles MacNab, Ottawa.

Edmonton, Alta.
A by-law has been passed authorizing the expenditure of $275,000 on the construction of a sewage disposal plant at Forest Heights. The City Council have not yet decided when work will start. Engineer, A. J. Latornell.

Grantham Township, Ont.
The Township Council have requested the St. Catharines Waterworks Commission to supply water to Orchard Park and are having plans and estimates prepared to submit to the City Council. Clerk, L. S. Bessey, Queenston Street, St. Catharines.

London, Ont.
Chipman & Power, 204 Mail Building, Toronto, are preparing plans for a storm sewer to be laid on Adelaide Street for the City Council. The construction of a sanitary sewer to Carlings Heights is also being considered by Council. Clerk, S. Baker.

Markham, Ont.
The Village Council will submit a bylaw to the ratepayers on January 1st to authorize the construction of sidewalks at an approximate cost of $5,000. Clerk, M. White.

Meaford, Ont.
The Town Council will submit a bylaw on January 3rd to authorize alterations to the waterworks system at an approximate cost of $4,000. Clerk, G. J. Albery.

Ottawa, Ont.
The City Council are considering the construction of wood block and asphalt pavement on Wellington Street, at an estimated cost of $138,000. Engineer, F. C. Askwith.

A by-law will be submitted to the ratepayers on January 3rd to authorize the construction of a sewer at an estimated cost of $315,000. Work will not start until the by-law has been endorsed. Engineer, F. C. Askwith.

Pickering, Ont.
A by-law authorizing the expenditure of $10,000 on drainage work has been passed. Tile, stone and timber construction. Clerk, D. R. Beaton, Whitevale, Ont.

Rochester Township, Ont.
The Township Council have passed a by-law providing for drainage work, estimated to cost $10,370. Clerk, M. N. Mousseau, South Woodslee, Ont.

Scotstown, Que.
The Town Council propose to lay watermains across the Salmon River. Work to start next year. Clerk, S. Boy.

Wellington County, Ont.
The County Council propose to construct 320 miles of roads during the coming season. Road Superintendent, John Young, Harriston, Ont.

Railroads, and Bridges Wharves

Bexley Township, Ont.
The Grand Trunk Railway Company, Montreal, have been authorized to construct two spurs for the Gulf River Lumber Company, Limited, Lots 16 and 17, Gulf Lake, Victoria County.

Chatham, Ont.
The Board of Railway Commissioners have empowered the Canadian Pacific Railway Company, Montreal, to construct an industrial siding for W. Rennie & Company, Limited, mileage 65.10, Windsor Sub-division.

London, Ont.
The Spramotor Company, King Street, are considering the construction of a siding into the old plant of the London Gas Power Company. Work will start in the spring. Manager, W. H. Heard.

Moncton, N.B.
The Moncton Tramways, Electricity & Gas Company, Limited, 38 Mechanic Street, contemplate the construction of about one and a half miles of track next summer.

Nanaimo, B.C.
City Engineer W. A. Owen has been instructed to prepare plans for a bridge to connect Bridge Street with Newcastle Townsite. City Clerk, A. L. Rattray.

Niagara Falls, Ont.
Application has been filed at Ottawa for the incorporation of the Ontario Niagara Connecting Bridge Company. The Company propose to construct a bridge and railway over the Niagara River. Solicitor, Alexander Fraser, 32 Erie Avenue.

St. Lin, Que.
Permission has been granted to the Canadian Pacific Railway Company for the construction of an industrial spur for Morin, Gareau & Beaudoin at mileage 15.1, St. Lin Sub-division.

Watford, Ont.
The Grand Trunk Railway Company intend to replace the present wooden bridge over the tracks with a steel structure. Work will be done by the Company's Construction Department. Superintendent, W. Davidson, London, Ont. Approximate cost, $5,000.

CONTRACTS AWARDED

Peace River Crossing, Alta.
Work has been started on the erection of a bridge over the North Heart River for the Edmonton, Dunvegan & British Columbia Railway. The contract for supply of steel has been let to the Dominion Bridge Company, Canada Building, Winnipeg, and for work on superstructure to McPherson & Quigley, 119 Adams Building, Edmonton.

Quebec, Que.
The contract for roofing required in connection with the dry dock in course of construction for the Department of Public Works, Ottawa, has been awarded to G. W. Reed & Company, Limited, 37 St. Antoine Street, Montreal.

Toronto, Ont.
In connection with the bridge to be built on Mount Pleasant Road for the Board of Control, the contract for masonry, concrete and general work has been awarded to the Raymond Construction Company, 89 Castle Frank Road, at $22,136, and the steel work to the Dominion Bridge Company, 20 Victoria Street, at $10,962. These contracts are subject to the approval of Council.

Public Buildings, Churches and Schools

Joliette, Que.
The School Commissioners will call for new tenders on the erection of a school in the spring. Secretary, J. M. Mondor.

Louisburg, C.B.
Tenders are being received on heating and plumbing required at the school which has been erected for the Town Council by Angus McAskill, Glace Bay, N. S.

Montreal, Que.
A. Filion & Frere, 2419 St. Denis Street, general contractors for the school which is now being built for the School Commissioners of St. Francis Soland, will do all the remainder of the work.

Quebec, Que.
In connection with the Chapel which is being built for the Patronage Laval, St. Sauveur Street, tenders will be called in the spring for remaining trades. General and masonry contracts have been let.

St. Cyrille de L'Islet, Que.
All work required in connection with the Parish Church now in course of erection will be done by the general contractor. Day labor will be emplayed.

St. Luc, Que.
Work on the erection of the Parish Church will start in the spring. No sub-contracts have yet been awarded.

Valbryant, Que.
In connection with the Parish Church, now in course of erection, tenders will be called shortly for interior work, carpentry, plastering, painting and fittings. Architect, O. Beaule, 19 d'Aguillon St., Quebec.

Vancouver, B.C.
The School Board are considering the erection of a school in South Hastings. Site has been purchased. Chairman, F. W. Welsh.

Welland South, Ont.
Work has been started on the erection of a school for the Trustees of School Section No. 3. Seats, furniture and school supplies will be purchased at once. Particulars from the Secretary, Leonard Matthews, Welland Post Office.

CONTRACTS AWARDED

Bassano, Alta.
The contract for the installation of interior fittings at the Post Office has been let by the Department of Public Works, Ottawa, to the Berlin Interior Hardwood Company, 72 Wilmot Street, Berlin.

Cartierville, Que.
In connection with the Church now in course of erection on Main Street for the Roman Catholic Congregation, the contract for reinforcement has been let to W. H. Wardell, 413 New Birks Building, Montreal, and the electrical work to the International Electric Company, 97 Bleury Street, Montreal.

Saskatoon, Sask.
The Dominion Government Department of Public Works have let the contract for additions to the interior fittings at the Post Office, Fourth Avenue and 23rd Street, to J. T. Schell Company, Kenyon Street, Alexandria, Ont.

Toronto, Ont.
In connection with the alterations and additions now in progress at St. Mark's Church, Ford and Connolly Streets, the contract for masonry has been awarded to Elgie & Page, 18 Toronto Street.

Business Buildings and Industrial Plants

Cap Madeline, Que.
The correct address of the Union Bag & Paper Company, who propose to erect a print and sulphide mill here, is Hudson Falls, N.Y.

Edmonton, Alta.
The construction of stock yards for the Edmonton Stock Yards Company will probably be started this month. Work by day labor under supervision of F. Ashley, care of E. B. Edwards, 133 Jasper Avenue.

Kingsville, Ont.
The Dominion Government Department of Marine & Fisheries are preparing plans for a large fish hatchery and buildings. Particulars from Lambert Wigle, M.P., Kingsville.

Leamington, Ont.
The Foster Tobacco Company are considering the erection of an addition to their factory, estimated to cost $3,000. Manager, J. J. Foster.

Levis, Que.
The erection of a slaughter house on Napoleon Street is being considered by J. H. Carrier & Fils, St. Romuald Street. Approximate cost, $8,000

Montreal, Que.
The Grand Trunk Railway Company have started repairing their machine shop on Sebastopol Street, which was recently damaged by fire. Work is being done by day labor under supervision of the Master Mechanic's Department. Steel and brick construction. Some equipment will be required.

Ottawa, Ont.
Work has been started by G. A. Eaman & Son, Isabella and O'Connor Streets, on the erection of an office and residence on Chamberlain Street. Stucco and ironclad construction, concrete foundation, felt and gravel roofing. Estimated cost, $3,500.

Prescott, Ont.
Tenders are now being received on the installation of an elevator and low pressure steam heating plant, with cast iron boiler, at the building which has been acquired by the Newell Manufacturing Company, Patterson Street, Ogdensburg, N. Y. Engineer, W. H. Wardwell, 413 New Birks Building, Montreal.

Quebec, Que.
The Imperial Oil Company, 311 Dominion Bank Building, Toronto, are considering the construction of a plant for the production of asphalt.

Rideau, Ont.
Plans of a new townsite have been filed by the Canadian Northern Railway Company, Toronto, with the County Registrar. The Company propose to erect their Main Line roundhouse, repair shops and car shops on the site.

Ridgeway, Ont.
Chester Johnson has commenced the erection of a business block on Ridge Street. Concrete block construction.

St. Thomas, Ont.
The Hydro Electric Commission, City Hall, St. Thomas, will receive tenders until noon, January 15th, for the construction of a transformer station. Plans and specifications at office of the Commission.

Toronto, Ont.
The Toronto Carpet Company, 1791 King Street West, have started work on the construction of a boiler room at the premises at Liberty and Mowatt Streets. Boilers purchased from Goldie & McCulloch Company, Galt, Ont. Steel and brick construction, gravel roofing. Approximate cost, $25,000.

Plans have been prepared for the erection of an addition to the storage warehouse of the Mounce Company, Limited, 344 Parliament Street. Tenders will be called shortly. Steel and brick construction. Estimated cost, $5,000.

Woodstock, Ont.
Arthur Patrick, Market Square, has purchased a site on Dundas Street for the erection of two stores. Work will start in the spring.

CONTRACTS AWARDED

Lachine, Que.
The contract for plastering required at the new Fire and Police Station, Tenth Avenue, has been let by the City Council to F. X. St. Amour, 13th Avenue.

Montreal, Que.
In connection with the Parisien Hotel now in course of erection on St. Catherine Street E. for T. Bastien, 5 Beaver Hall Square, the contract for installation of refrigerator plant has been awarded to the Canadian Ice Machine Company, Limited, 20 St. Nicholas Street, and the heating and plumbing to James Ballantyne, 163 Nazareth Street.

The Canada Cement Company, Limited, Herald Building, have commenced the erection of an open hearth furnace building and an electric furnace building. The contract for supply of steel has been let to the Structural Steel Company, Limited, New Birks Building. Frame, steel and corrugated iron construction.

The general contract for the erection of a foundry for the Williams Manufacturing Company, Limited, 1789 St. James Street, has been awarded to Reid, McGregor & Reid, 511 St. Catherine Street West, and the contract for steel to Structural Steel Company, New Birks Building.

Ottawa, Ont.
The general contract for the erection of a stable for Mrs. T. Lemay, 349 Murray Street, has been awarded to Joseph Tremblay, 349 Murray Street. Ironclad construction, concrete foundation, corrugated iron roofing.

The following contracts have been awarded in connection with the remodelling of a building for the Merchants Bank of Canada, 10 Metcalfe Street:—painting and glazing, A. E. Rae Company, Sussex Street; heating and plumbing, J. T. Blyth, Frank Street; electrical work, Capital Electric Company, 344 Sparks Street

Paris, Ont.
In connection with the factory which is being built for the Paris Wincey Mills Company, Limited, the contract for the installation of a sprinkler system has been let to Purdy, Mansell Company, 63 Albert Street, Toronto.

Quebec, Que.
Work has been started on the conversion of a building at Third Avenue and Sixth Street, Limoilou, into a bank for the Hochelaga Bank, Montreal. The general, masonry and carpentry contracts have been let to F. Paquet & Company, 18 Couillard Street. Sub-contracts for heating and electrical work will be let by owners.

Residences

Brockville, Que.
Plans are being prepared by Barott, Blackader & Webster, New Birks Building, Montreal, for alterations and additions to the residence of J. A. Mackay, Prescott Road. Tenders will be received between January 20th and 30th.

Huntsville, Ont.
Plans are being prepared for a cottage to be built for J. S. Barker, 8 Park Place, St. Catharines. Work will start in the spring.

London, Ont.
The erection of a residence is contemplated by Adolphus Evans. Work

will start in the spring. Estimated cost, $3,000.

Montreal, Que.
John Dominique, 166 Marcil Avenue, will do all the work required in connection with the residence which he is building on Marcil Avenue.

Niagara Falls, Ont.
R. J. Jolley & Company, 106 Maple Street, have commenced the erection of a residence on Victoria Avenue, estimated to cost $3,000. Contracts will be let for plumbing and electrical work. Brick construction.

Quebec, Que.
O. Beaule, Architect, 19 d'Aguillon Street, is preparing plans for a residence to be built on Park Avenue for E. Barry, 381½ St. Joseph Street. Work will start in the spring. Brick construction, concrete foundation, metal roofing. Approximate cost, $7,000.

Toronto, Ont.
Purton & Chennells, 634 Christie St., are building a residence on Frederica St., estimated to cost $3,000. Smaller trades will be let. Brick construction, shingle roofing.

Venn & Evans, 776 Crawford Street, are about to erect a pair of residences at 14 Palmerston Square. Smaller trades will be let. Brick construction, tar and gravel roofing.

CONTRACTS AWARDED

Lachine, Que.
In connection with the residence which is being built on 44th Avenue for A. Martin, 393 St. Joseph Street, the contract for roofing has been let to the Canadian Asbestos Company, 44 Youville Square, Montreal, the plastering to E. Labelle, 75 Eleventh Avenue, and heating and plumbing to A. Binette, 52 19th Avenue. Masonry and carpentry by day labor.

Maisonneuve, Que.
In connection with the residence which is being built on LaSalle Street by J. T. Legault, 30 St. James Street, Montreal, the contract for roofing has been awarded to W. Theriault, 283 William David Street.

Montreal, Que.
Work has been started on the erection of two residences on Grosvenor Avenue for Thomas Lamb, Board of Trade Building. The general contract has been let to T. S. Hudson & Company, Board of Trade Building, and the electrical work to the Vincent & Say Electric Company, 25 Union Avenue.

In connection with the residence which has been erected at 115 Marlowe Street by G. E. Blackwell, 4184 St. Catherine Street, Westmount, the contract for roofing has been let to Sibley & Huot, 34 St. Martin Street.

The contract for roofing required in connection with the residence which is being built on Brock Avenue N. by Reid, McGregor & Reid, 511 St. Catherine St. W., has been let to Richardson, Simard & Company, 745 Clarke Street, and the heating and plumbing to T. L. Bain, 31 Westminster Avenue. Remainder of work will probably be done by owner.

Montreal West, Que.
The following contracts have been let in connection with the residence which is being built by J. Kirkpatrick, 37 Fenwick Avenue:—bricklaying, J. Deslauriers, 48 De Villiers Street; plastering, A. Leger, 96 Fourth Avenue, St. Pierre; plumbing and heating, T. Bain, 31 Westminster Avenue; electrical work, E. Gregory, 1594 Cadieux Street. Masonry, carpentry, roofing, painting and interior fittings by owner.

Ottawa, Ont.
The contract for electrical work required at the residence in course of erection on Fifth Avenue for T. J. Somerville, 28 Waverly Street, has been let to Charles Presby, 138 Irving Avenue. Owner will do greater part of work.

W. C. Leech, 140 Spadina Street, has commenced the erection of a residence on Irving Avenue, estimated to cost $3,500. The contract for heating and plumbing has been let to F. Holtz, care of owner, and the electrical work to C. Presby, 138 Irving Avenue. Brick veneer construction, stone foundation, shingle roofing.

Quebec, Que.
Work has been started on the erection of a residence for J. E. Myrand, 144 Latourelle Street. The general contract has been let to J. L. Myrand, Ste. Foye Road. Frame and brick construction, concrete foundation, felt and gravel roofing. Estimated cost, $4,000.

W. Bouchard, 102 Fifth Street, Limoilou, has commenced the erection of two residences on Dolbeau Street for A. Demeules, 174 Des Stigmates Street. Frame and brick construction, concrete foundation. Approximate cost, $10,000.

Toronto, Ont.
Work has been started by the International Land Corporation, 43-45 King Street West, on the erection of four pairs of residences on Roper Street. The contract for excavation and supply of sand has been let to International Contractors Limited, 2459 Yonge Street. Smaller trades will be let. Brick construction, shingle roofing. Approximate cost, $12,800.

Verdun, Que.
The contract for roofing in connection with the erection of a nurses' residence at the Protestant Hospital for Insane, 209 LaSalle Road, has been awarded to G. W. Reed & Company, Limited, 37 St. Antoine Street.

Power Plants, Electricity and Telephones

Burgessville, Ont.
A by-law has been carried authorizing the construction of a hydro system at an estimated cost of $3,500. Clerk to the Township of North Norwich, C. E. Burgess, Burgessville.

Forest, Ont.
A by-law will be submitted to the ratepayers on January 3rd to authorize the installation of a hydro electric system. Town Clerk, R. Karr.

Huntsville, Ont.
Plans for remodelling the electric light plant are now in the hands of local contractors, who will submit prices to the Town Council.

Medicine Hat, Alta.
The Lake-of-the-Woods Milling Company, South Railway Street, are considering the installation of heavier power plant machinery. General Manager, W. A. Mathieson.

Vancouver, B.C.
Application has been filed at Ottawa for the incorporation of the Western Canada Telephone Company. The operation of a telephone system in the Province of British Columbia is proposed. Solicitors, McPhillips & Wood, 718 Granville Street.

Wellesley, Ont.
The Town Council will submit a bylaw to the ratepayers on January 3rd to authorize the installation of a power distribution system at an approximate cost of $7,500.

West Lorne, Ont.
A by-law authorizing the installation of a hydro electric system has been carried. Town Clerk, J. S. Robertson.

Fires

Barker's Point, N.B.
The residence of George Fulton has been entirely destroyed by fire. Loss, $2,000.

Fort Erie, Ont.
Fire has destroyed the following property:—two stores and Post Office, owned by C. E. Harris, and two stores, owned by E. Hawkins. Total loss, about $14,000, partly insured.

The barn owned by W. L. Curtis has been totally destroyed by fire. Loss, about $3,000.

Latuque, Que.
Fire has destroyed the residence of J. Harvey.

Liverpool, N.S.
Fire has entirely destroyed the store owned by the McClearn Company, Limited, Main Street. Loss, about $5,000.

Lucan, Ont.
The factory owned by Herman Wells has been totally destroyed by fire. Loss is partly covered by insurance.

Ottawa, Ont.
Fire has destroyed a residence on Nicholas Street, the property of the Estate of John O'Leary, 208 Laurier Avenue. Loss, $3,500. Owners expect to rebuild.

Parry Sound, Ont.
A business block on James Street, the property of A. Logan, James Street, has been destroyed by fire. Loss, $20,000, partially insured.

Scotsguard, Sask.
Fire has destroyed an elevator owned by the Pioneer Elevator Company. Loss, $40,000.

St. John, N.B.
The departmental store on Market Square, owned by W. H. Thorne & Son, has been partly destroyed by fire. Loss, $150,000, covered by insurance.

St. Urbain, Que.
The business premises and residence of Pierre Tremblay have been entirely destroyed by fire.

Toronto, Ont.
The store of J. H. Bardwell, 722 Queen Street E., has been destroyed by fire. Loss on building, $5,000.

Waterloo, Ont.
The store and residence owned by F. Barrington, Foster Square, have been totally destroyed by fire. Loss, $7,000, partially covered by insurance.

Miscellaneous

Calgary, Alta.
The Western Canadian Natural Gas Company, care of Eugene Coste, 2208 Amherst Street, have plans in progress for the supply of natural gas to all the towns along the line of the Canadian Pacific Railway between Calgary and Winnipeg, as well as Edmonton and other northern towns. The Company are now negotiating with some of these cities.

London, Ont.
The Webster Construction Company, Bank of Toronto Building, contemplate the manufacture of cement blocks, and desire prices and other information on the necessary machinery.

Winnipeg, Man.
Tenders will be received until noon, January 10th, at the office of the Greater Winnipeg Water District, 901 Boyd Building, for the supply of rock crushing plant. Specifications at office of the District.

Late News Items

Athabasca, Alta.
George Watt, Secretary to the School Board, will receive tenders until noon, January 14th, for the erection of a frame school. Plans and specifications with Secretary.

Chatham, Ont.
The carriage works of William Gray, Sons & Campbell, Ltd., 78 William Street, have been destroyed by fire.

Hamilton, Ont.
Tenders are now being received by the Mayor, Chester S. Walters, on the supply of one combination chemical and motor truck. Specifications at office of the Fire Chief, Ten Eyck.

The contract for heating and plumbing required at the residence which has been erected on Markland Street for been destroyed by fire. Loss on building and machinery, about $100,000.

The following contracts have been let in connection with the garage in course of erection for H. L. Lees, Main Street E.:—carpentry, J. Vogan, Sanford Avenue N.; roofing, Thomas Irwin & Sons, McNab Street S.; painting, Smith & Omand, Walnut Street S.; heating and plumbing, A. Clark, Main Street W.; electrical work, C. Chadwick, King Street E.

Montreal, Que.
The contract for marble, tile and terrazzo work at the Parisien Hotel, now being built for T. Bastien, 5 Beaver Hall Square, has been awarded to the Mariotti Marble Company, Provencal Lane.

Murray Bay, Que.
Tenders will be received until 4 p.m., January 10th, by R. C. Desdochers, Department of Public Works, Ottawa, for the installation of fittings at the Post Office. Plans and specifications with J. Forgues, Clerk of Works, Murray Bay, A. Dupuis, District Engineer, Post Office Building, Quebec, and at the Department. Specifications only at office of MacLean Daily Reports, 25 Charlotte Street, Toronto.

Ottawa, Ont.
Shuttleworth & Black, 24 Euclid Avenue, are building four stores at Bank and Sunnyside Streets for Graham Bros., 205 Laurier Avenue. The contract for steel work has been let to McFarlane & Douglas, 212 Slater Street, and for plastering to Murphy & Morrow, 139 Waverley Street. Other contracts not yet awarded. Estimated cost, $7,000.

Sault Ste. Marie, Ont.
The contract for heating and plumbing required in connection with the new Gaol Building has been transferred by the Department of Public Works, Toronto, to the Cochrane Hardware Company, 388 Queen Street E.

St. Lambert, Que.
L. E. Kimpton, Notre Dame Street, is building a residence on Mercille Street, estimated to cost $5,000. The contract for heating and plumbing has been let to J. Trudeau, Lorne Avenue. Brick construction, asbestos roofing.

Toronto, Ont.
The factory of the Martin Paper & Box Company, 353 Pape Avenue, has of six flats on Verdun Avenue. Brick construction, felt and gravel roofing. Approximate cost, $4,500.

Verdun, Que.
Work has been started by H. Cuenier, 1193 Wellington Street, on the erection

E. D. Sifton, City Hall, has been awarded to A. Clark, 7 Main Street W. Electrical work by owner.

Woodrow, Sask.
Work is progressing on the erection of a school. The general contract has been let to Frank Rooney, Third Street, Weyburn, Sask. Stucco and brick construction, tar and gravel roofing. Estimated cost, $6,250.

Adjustable Shores for Floor Forms on Concrete Buildings

A positive clamp, which sets itself when the cam is in driving position and the shore is under load, is a feature of the new Hodges forms for concrete building work, sold by Edward O. Keator & Company, of Cincinnati. This new shore also has a detachable head, which may be left on, in setting shores under a beam, or removed, in using the shores for flat slab floors, so that the form stringers rest in a fork made by the two upper pieces of the shore, which makes it unnecessary for a man to climb up and nail cleats on each side of the joist after the shore is in place.

These shores are used with steel-wood adjustable mat forms. They are made from 8-ft. lumber, with a 4 x 4-inch post and 2 x 4-inch side pieces. The positive clamp introduced in the later models has a clamp head which bites into the 4 x 4-inch post and insures a strong grip as soon as the cam is set. The upper clamp stiffens the shore and transfers to the middle timber part of the load from the 2 x 4-inch piece opposite the cams. This 2 x 4 also bears on the head of the lower clamp. The shores are adjustable from 8 to 14 feet, when made of 8-foot lumber. This range is sufficient for ordinary construction, but longer shores can, of course, be built for special work.

The Weldless Pile Band Company, 95-97 Nassau Street, New York City, has placed a patented weldless pile band on the market, which, it is claimed, will enable the driving of four times as many piles in a given period of time as can be driven with the old-style solid steel or iron band. It is also claimed that its use eliminates the following items of expense: the bursting of the band under the continued blows of the heavy drop hammer, which necessitates rewelding; the loss of time while another band is being secured and placed in position, and the splitting of the pile occasioned by the bursting of the band.

ELECTRIC and HAND POWER TRAVELING CRANES
Electric Bucket Cranes, Mono-Rail Hoists, Power Plant Cranes,
Jib Cranes, Dock Cranes, Railway Cranes, Derricks.
—*Made in Canada*—
NORTHERN CRANE WORKS, Ltd., Walkerville, Ont.

Tenders and For Sale Department

Debentures For Sale

Bids will be received by the undersigned until January 17, 1916, for $130,000 debentures, being $80,000 for construction of sewers and waterworks, and $50,000 for construction and equipment of an electric-light system in the town of The Pas, Manitoba.

Duration—20 years, payable at end of term.

Rate—5 per cent. per annum, payable yearly, on the second day of August. Coupons attached.

Date of debentures—August 2, 1915.

Assessment—**$2,482,670.**

Rate of taxation—general, 11 2/10 mills; school, 3 mills; debentures, 5 mills.

Debenture debt (this issue included)—$250,000.

The above issue is guaranteed as to principal and interest by the Provincial Government.

H. H. ELLIOTT,
Town Clerk.

47-52

Board of Education

BIDS

for the Erection of Addition to the Windsor Collegiate Institute, Windsor, Ont.

Sealed proposals will be received at the office of the Secretary of the Board of Education, 5, 6 and 7 LaBelle Building, Windsor, Ont., until 12 o'clock noon, **Monday, the 31st day of January, 1916,** for the furnishing of material and the performance of labor required for the completion of the addition to the Windsor Collegiate Institute, situated on the school site, bounded on the north by present school building, on Ann Street, on the east by Windsor Avenue, and on the west by Goyeau Street.

Plans will be given out for figuring on and after Morday, December 27, 1915.

Proposals will be received as follows:—

Proposals for all separate classes of the work.

Proposals for the entire job.

Proposals under four bid form:—

(1) Mason work, including Tile and Terrazzo Work; Reinforced Concrete Work; Lathing and Plastering; Structural Steel and Ornamental Iron Work.

(2) Carpenter Work, including Painting and glazing.

(3) Plumbing, Sheet Metal Work and Roofing, and Heating and Ventilating.

(4) Electric Wiring.

Plans and specifications covering all work may be seen at the office of the Architect, J. C. Pennington, 35 LaBelle Building, Windsor, Ont.

All proposals must be accompanied by a certified cheque or cash equal to five per cent. of the bid. A Surety Company Bond will not be accepted in connection with the submitting of proposals.

General contractors must submit, attached to their proposals, the names of all their sub-contractors.

A cash deposit of ten dollars will be required with each set of plans taken out of office, this sum to be refunded on return of plans. The Board of Education reserves the right to reject any or all of the bids.

J. C. PENNINGTON,
Architect.

52

School Tenders

Tenders for all trades in connection with the erection of addition to St. Joseph's, St. Clare's, and St. Anthony's Separate Schools and new school for St. Monica's Parish, for the Separate School Board for the City of Toronto, will be received until 5 p.m., **Wednesday, January 26, 1916**, at the office of the Board, 67 Bond Street.

Tenders to be submitted on forms supplied and to be addressed to E. F. Henderson, Chairman of Sites and Buildings Committee, and to be accompanied by a marked cheque for 10 per cent. of the amount of tender.

Plans and specifications may be seen at the office of the Architect, Charles J. Read, Rooms 203-4 Confederation Life Building, Toronto.

52-2-3

The Quebec Streams Commission

Proposed Bridge on the River Sauvage at Lambton, County Frontenac, P. Q.

Notice to Contractors

Sealed tenders, addressed to the undersigned, and marked "Tenders for a bridge over the Sauvage River," will be received at the office of the Quebec Streams Commission, Room 125, Parliament Buildings, Quebec, until twelve o'clock on **Tuesday, the 11th day of January, 1916.**

These tenders shall be for the following items:

(A) Tender for a wooden bridge, wooden piers and abutments and bridge approaches.

(B) Tender for Concrete Piers and Abutments and Bridge approaches.

(C) Tender for Steel Superstructure of Bridge.

(D) Tender for Items B and C combined, viz.: Concrete Substructure and Steel Superstructure.

Any tenderer may submit prices for one or all of the above items.

Plans and specifications can be seen after this date in the office of the Chief Engineer of the Quebec Streams Commission, Room 803 McGill Building, Montreal.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labor of the Province of Quebec, which schedule will form part of the contract.

Tenderers are notified that tenders will not be considered unless made strictly in accordance with the printed forms.

An accepted bank cheque for a sum as mentioned below made payable to the Hon. the Provincial Treasurer, must accompany each tender, which sum will be forfeited should the party tendering decline to enter contract for the work, at the rate stated in the offer submitted.

Item "A" cheque for $2,500.00.

Item "B" cheque for $4,000.00.

Item "C" cheque for $3,000.00.

Item "D" cheque for $7,000.00.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security for the due fulfilment of the contract to be entered into.

The lowest or any tender will not necessarily be accepted.

By Order,
L. H. CHARLEBOIS,
Secretary.

The Quebec Streams Commission,
Montreal, December 23rd, 1915.

Unauthorized publication of this advertisement will not be paid for. 52-1

School Tenders

Sealed tenders will be received up to and including **Saturday, January 15, 1916,** by the Secretary of the School Board, Lambton Mills, in whole or in part, for the different trades required in the erection and completion of a school building. Plans and specifications and all particulars can be seen at Molson's Bank, Lambton Mills; also at the offices of the architects. No tender necessarily accepted. A guarantee bond for 10 per cent. will be required from the parties to whom the contract may be awarded.

THOMAS ELLIOT,
Secretary-Treasurer School Board,
Lambton Mills, Ont.

Ellis & Ellis, Architects,
Manning Chambers, Toronto.

51-1

Tenders for Hydro-Electric Unit

The Corporation of the Town of Grand'Mere is asking tenders for supplying and installing a second hydro-electric unit, being a perfect duplicate of the one now being used by the said Corporation, at Shawinigan Falls.

The tender forms and specifications are deposited at the office of the Secretary-Treasurer, where parties interested can obtain copies on request.

Tenders must be endorsed "Tender for the erection of an Hydro-Electric plant for the Town of Grand'Mere," and addressed to the Secretary of the Town of Grand'Mere, Que.

Tenders will not be considered unless accompanied by a cheque for five hundred dollars, accepted by a chartered bank, nor unless made on forms furnished by the Secretary of the above mentioned Corporation. No tenders will be received after the fifth day of January, 1916, at 4 o'clock p.m.

The lowest or any tender not necessarily accepted.

SECRETARY-TREASURER.

Grand'Mere, Que.
December 21st, 1915.

52

Tenders for Supplies

Tenders will be received by registered post only, addressed to the Chairman, Board of Control, City Hall, Toronto, up to 12 o'clock noon on **Tuesday, January 11th, 1915**, for the supply and delivery of—

No. 34. Red Lead Paint for Bloor Street Viaduct.

No. 74. Cast Iron Special Castings for Main Pumping Station.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications and forms of tender may be obtained at the Works Department, Room 12, City Hall, Tenderers must comply strictly with conditions of City By-law as to deposits and securities, as set out in specifications and forms of tender. The lowest or any tender not necessarily accepted.

T. L. CHURCH, Mayor,
Chairman, Board of Control.

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Engin.

Engineering and contract
record

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